

MONOPOLE ELEMENT AT THE CENTER OF A CIRCULAR GROUNDPLANE
OF ARBITRARY RADIUS
VOLUME 2: APPENDICES

By

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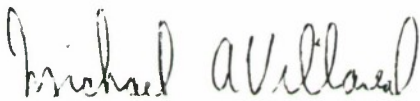
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<p>The input impedance, field strengths, and directive gain of a monopole element at the center of a circular groundplane in free space are determined for arbitrary groundplane radius, element length, and element radius. Numerical results are obtained by using various models and are compared with measurements. Particular emphasis is given to groundplane radii that are small or comparable to a wavelength.</p> <p>The models include the induced EMF method, integral equation method, method of moments, oblate spheroidal wave functions, variational method, the method of moments combined with the geometric theory of diffraction, and the method of images.</p> <p>This report is in two volumes. Volume 1 contains the theory and results. Volume 2 contains the computer printouts of directive gain and the listings of the computer programs for the various models.</p>					
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- 18. Groundplane of Zero Extent
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 - Input Impedance
 - Integral Equation Method (Bardeen)
 - Method of Images
 - Method of Moments (Richmond)
 - Monopole Antenna
 - Monopole Element
 - Oblate Spheroidal Wave Functions (Leitner and Spence)
 - Radiation Pattern
 - Radiation Resistance
 - Scalar Diffraction Theory (Tang)

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PREFACE

The Air Force SINGARS VHF-FM radio is a frequency-hopping anti-jam radio which utilizes an electrically short antenna to minimize aerodynamic drag on airborne platforms. The development of optimally efficient, electronically tuneable antennas for this radio is of interest. Although the antenna groundplane is platform-dependent, it is usually small compared to an rf wavelength. A circular groundplane provides a standardized groundplane geometry with which to model and evaluate candidate antennas. Accordingly, a VHF antenna range with an 8 ft. diameter circular groundplane has been constructed at The MITRE Corporation to evaluate candidate antennas.

The electrical properties of a monopole element at the center of a circular groundplane of finite radius are of interest to this program for (a) qualifying the antenna range; (b) establishing antenna standards with which to measure test antennas; and (c) modeling candidate antennas. Our survey of the literature revealed that although this antenna has the simplest geometry of any monopole antenna, its properties are neither well understood nor standardized, particularly for groundplane radii which are small or comparable to a wavelength. The present paper attempts to address this deficiency.

FOREWORD

M. Weiner wrote Sections 1 - 5. S. Cruze contributed to Section 3.5 and wrote program MONOPL in Appendix B3. C. Li contributed to Section 3.4; edited program RICHMD1 in Appendix B2 and program AWADALLA in Appendix B5; and wrote program BARDEEN in Appendix B1, program RICHMD2 in Appendix B2, and program MONOSTOR in Appendix B4. W. Wilson contributed to Sections 2.3 and 3.3. J. E. Kriegel of The MITRE Corporation derived the correct form of the continued fractions given in Eqs. 3.5-4 and 3.5-5 and contributed to the evaluation of the limits in Eqs. 3.3-22--3.3-24. W. C. Corrieri skillfully performed the measurements discussed in Section 5. K. Pamidi contributed to the development of Eq. 3.3-16.

The authors are grateful to Prof. Alfred Leitner of Rensselaer Polytechnic Institute for helpful conversations regarding his method of oblate spheroidal wave functions; Prof. Jack Richmond of Ohio State University for helpful conversations and a magnetic tape of his method of moments program; and Prof. Kamal Awadalla of Menoufia University (Egypt) for helpful correspondence including a listing of his program for the method of moments combined with the geometric theory of diffraction.

After the authors had obtained results using the integral equation method and the method of oblate spheroidal functions, it was possible to confirm the correctness of Prof. Richmond's method of moment results which were subsequently published in the open literature (see Ref. [2]).

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APPENDIX A. COMPUTER PRINTOUTS OF DIRECTIVE GAIN AND THE FAR-FIELD
ELEVATION PATTERN

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APPENDIX A1. INTEGRAL EQUATION

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TABLE A1-1

INTEGRAL EQUATION METHOD
 EPSILON= 0.0 (NORMALIZED GROUNDPLANE RADIUS)
 MONOPOLE LENGTH= 0.250000(WAVELENGTH)
 INFINITELY THIN MONOPOLE RADIUS
 RADIATION RESISTANCE = 19.434878 (OHMS)

ELEVATION ANGLE θ (DEG)	DIRECTIVITY (NUMERIC)	DIRECTIVITY (DBI)	RELATIVE POWER (DB)	ELEVATION ANGLE (DEG)	DIRECTIVITY (NUMERIC)	DIRECTIVITY (DBI)	RELATIVE POWER (DB)
0.	0.00000	-INFINITY	-INFINITY	92.0	1.54040	1.87635	-0.00604
2.0	0.00163	-27.88102	-29.76341	94.0	1.53399	1.85821	-0.02418
4.0	0.00651	-21.86343	-23.74582	96.0	1.52334	1.82796	-0.05443
6.0	0.01463	-18.34664	-20.22903	98.0	1.50853	1.78553	-0.09686
8.0	0.02597	-15.85494	-17.73733	100.0	1.48966	1.73087	-0.15152
10.0	0.04050	-13.92589	-15.80828	102.0	1.46886	1.66389	-0.21850
12.0	0.05816	-12.35253	-14.23592	104.0	1.44028	1.58446	-0.29793
14.0	0.07892	-11.02803	-12.91042	106.0	1.41009	1.49247	-0.38992
16.0	0.10271	-9.88386	-11.76625	108.0	1.37649	1.38774	-0.49464
18.0	0.12946	-8.87877	-10.76116	110.0	1.33971	1.27010	-0.61229
20.0	0.15908	-7.98396	-9.86635	112.0	1.29996	1.13930	-0.74309
22.0	0.19147	-7.17889	-9.06128	114.0	1.25751	0.99511	-0.88728
24.0	0.22654	-6.44846	-8.33085	116.0	1.21261	0.83722	-1.04517
26.0	0.26417	-5.78120	-7.65359	118.0	1.16554	0.66528	-1.21711
28.0	0.30421	-5.16823	-7.05062	120.0	1.11659	0.47892	-1.40347
30.0	0.34653	-4.60256	-6.48495	122.0	1.06603	0.27768	-1.60471
32.0	0.39097	-4.07857	-5.96096	124.0	1.01415	0.06104	-1.82135
34.0	0.43735	-3.59167	-5.47406	126.0	0.96126	-0.17158	-2.05397
36.0	0.48550	-3.13812	-5.02050	128.0	0.90764	-0.42085	-2.30324
38.0	0.53521	-2.71478	-4.59717	130.0	0.85358	-0.68756	-2.56995
40.0	0.58627	-2.31905	-4.20143	132.0	0.79936	-0.97259	-2.85498
42.0	0.63845	-1.94870	-3.83109	134.0	0.74525	-1.27697	-3.15936
44.0	0.69153	-1.60188	-3.48427	136.0	0.69153	-1.60188	-3.48427
46.0	0.74525	-1.27697	-3.15936	138.0	0.63845	-1.94870	-3.83109
48.0	0.79936	-0.97259	-2.85498	140.0	0.58627	-2.31905	-4.20143
50.0	0.85358	-0.68756	-2.56995	142.0	0.53521	-2.71478	-4.59717
52.0	0.90764	-0.42085	-2.30324	144.0	0.48550	-3.13812	-5.02050
54.0	0.96126	-0.17158	-2.05397	146.0	0.43735	-3.59167	-5.47406
56.0	1.01415	0.06104	-1.82135	148.0	0.39097	-4.07857	-5.96096
58.0	1.06603	0.27768	-1.60471	150.0	0.34653	-4.60256	-6.48495
60.0	1.11659	0.47892	-1.40347	152.0	0.30421	-5.16823	-7.05062
62.0	1.16554	0.66528	-1.21711	154.0	0.26417	-5.78120	-7.65359
64.0	1.21261	0.83722	-1.04517	156.0	0.22654	-6.44846	-8.33085
66.0	1.25751	0.99511	-0.88386	158.0	0.19147	-7.17889	-9.06128
68.0	1.29996	1.13930	-0.74309	160.0	0.15908	-7.98396	-9.86635
70.0	1.33971	1.27010	-0.61229	162.0	0.12946	-8.87877	-10.76116
72.0	1.37649	1.38774	-0.49464	164.0	0.10271	-9.88386	-11.76625
74.0	1.41009	1.49247	-0.38992	166.0	0.07892	-11.02803	-12.91042
76.0	1.44028	1.58446	-0.29793	168.0	0.05816	-12.35253	-14.23592
78.0	1.46886	1.66389	-0.21850	170.0	0.04050	-13.92589	-15.80828
80.0	1.48966	1.73087	-0.15152	172.0	0.02597	-15.85494	-17.73733
82.0	1.50853	1.78553	-0.09686	174.0	0.01463	-18.34664	-20.22903
84.0	1.52334	1.82796	-0.05443	176.0	0.00651	-21.86343	-23.74582
86.0	1.53399	1.85821	-0.02418	178.0	0.00163	-27.88102	-29.76341
88.0	1.54040	1.87635	-0.00604	180.0	0.00000	-INFINITY	INFINITY
90.0	1.54255	1.88239	0.0				

TABLE A1-2

INTEGRAL EQUATION METHOD
 EPSILON= 0.2500(NORMALIZED GROUNDPLANE RADIUS)
 MONDPOLE LENGTH= 0.250000(WAVELENGTH)
 INFINITELY THIN MONDPOLE RADIUS
 RADIATION RESISTANCE = 19.480016 (DHMS)

ELEVATION ANGLE (DEG)	DIRECTIVITY (NUMERIC)	DIRECTIVITY (DBI)	RELATIVE POWER (DB)	ELEVATION ANGLE (DEG)	DIRECTIVITY (NUMERIC)	DIRECTIVITY (DBI)	RELATIVE POWER (DB)
0	0.00000	-INFINITY	-INFINITY	92.0	1.53686	1.86634	-0.00598
2.0	0.00164	-27.83892	-29.71123	94.0	1.53052	1.84839	-0.02393
4.0	0.00657	-21.82152	-23.69383	96.0	1.52000	1.81845	-0.05387
6.0	0.01477	-18.30504	-20.17735	98.0	1.50538	1.77646	-0.09586
8.0	0.02622	-15.81378	-17.68610	100.0	1.48674	1.72236	-0.14996
10.0	0.04088	-13.88530	-15.75762	102.0	1.46421	1.65605	-0.21627
12.0	0.05870	-12.31364	-14.18595	104.0	1.43794	1.57742	-0.29490
14.0	0.07964	-10.98895	-12.86125	106.0	1.40810	1.48633	-0.38599
16.0	0.10362	-9.84569	-11.71801	108.0	1.37487	1.38262	-0.48970
18.0	0.13057	-8.84163	-10.71395	110.0	1.33847	1.26608	-0.60623
20.0	0.16040	-7.94795	-9.82026	112.0	1.29912	1.13650	-0.73581
22.0	0.19301	-7.14411	-9.01642	114.0	1.25707	0.99361	-0.87871
24.0	0.22830	-6.41499	-8.28731	116.0	1.21258	0.83710	-1.03521
26.0	0.26613	-5.74914	-7.62145	118.0	1.16591	0.66664	-1.20568
28.0	0.30636	-5.13766	-7.00997	120.0	1.11733	0.48181	-1.39050
30.0	0.34886	-4.57354	-6.44586	122.0	1.06713	0.28217	-1.59014
32.0	0.39344	-4.05116	-5.92348	124.0	1.01559	0.06720	-1.80512
34.0	0.43995	-3.56594	-5.43825	126.0	0.96300	-0.16372	-2.03603
36.0	0.48819	-3.11410	-4.98642	128.0	0.90965	-0.41124	-2.28356
38.0	0.53796	-2.69252	-4.56484	130.0	0.85582	-0.67617	-2.54849
40.0	0.58904	-2.29858	-4.17089	132.0	0.80179	-0.95940	-2.83171
42.0	0.64120	-1.93004	-3.80236	134.0	0.74783	-1.26196	-3.13427
44.0	0.69422	-1.58504	-3.45735	136.0	0.69422	-1.58505	-3.45736
46.0	0.74783	-1.26195	-3.13426	138.0	0.64120	-1.93005	-3.80237
48.0	0.80179	-0.95939	-2.83170	140.0	0.58904	-2.29859	-4.17090
50.0	0.85582	-0.67616	-2.54847	142.0	0.53796	-2.69254	-4.56485
52.0	0.90965	-0.41123	-2.28355	144.0	0.48819	-3.11411	-4.98643
54.0	0.96301	-0.16371	-2.03602	146.0	0.43995	-3.56595	-5.43827
56.0	1.01559	0.06720	-1.80511	148.0	0.39344	-4.05118	-5.92349
58.0	1.06713	0.28218	-1.59013	150.0	0.34885	-4.57356	-6.44587
60.0	1.11733	0.48182	-1.39049	152.0	0.30636	-5.13767	-7.00999
62.0	1.16591	0.66665	-1.20567	154.0	0.26612	-5.74915	-7.62147
64.0	1.21258	0.83711	-1.03520	156.0	0.22830	-6.41501	-8.28732
66.0	1.25708	0.99362	-0.87870	158.0	0.19301	-7.14412	-9.01644
68.0	1.29912	1.13651	-0.73581	160.0	0.16040	-7.94796	-9.82028
70.0	1.33847	1.26609	-0.60623	162.0	0.13057	-8.84165	-10.71396
72.0	1.37487	1.38262	-0.48969	164.0	0.10362	-9.84571	-11.71802
74.0	1.40810	1.48633	-0.38598	166.0	0.07964	-10.98896	-12.86128
76.0	1.43794	1.57742	-0.29489	168.0	0.05870	-12.31365	-14.18597
78.0	1.46422	1.65605	-0.21626	170.0	0.04088	-13.88532	-15.75763
80.0	1.48674	1.72236	-0.14996	172.0	0.02622	-15.81380	-17.68611
82.0	1.50538	1.77646	-0.09586	174.0	0.01477	-18.30506	-20.17737
84.0	1.52000	1.81845	-0.05387	176.0	0.00657	-21.82153	-23.69385
86.0	1.53052	1.84839	-0.02393	178.0	0.00164	-27.83893	-29.71125
88.0	1.53686	1.86634	-0.00598	180.0	0.00000	-INFINITY	-INFINITY
90.0	1.53937	1.87231	0.0				

TABLE A1-3

INTEGRAL EQUATION METHOD
 $\epsilon_{\text{PSILON}} = 0.5000$ (NORMALIZED GROUNDPLANE RADIUS)
 MONOPOLE LENGTH = 0.250000 (WAVELENGTH)
 INFINITELY THIN MONOPOLE RADIUS
 RADIATION RESISTANCE = 19.618316 (OHMS)

ELEVATION ANGLE (DEG)	DIRECTIVITY (NUMERIC)	DIRECTIVITY (DBI)	RELATIVE POWER (DB)	ELEVATION ANGLE (DEG)	DIRECTIVITY (NUMERIC)	DIRECTIVITY (DBI)	RELATIVE POWER (DB)
0	0.00000	-INFINITY	-INFINITY	92.0	1.52609	1.83579	-0.00580
2.0	0.00169	-27.71176	-29.55335	94.0	1.51999	1.81841	-0.02318
4.0	0.00677	-21.69493	-23.53652	96.0	1.50988	1.78942	-0.05217
6.0	0.01521	-18.17942	-20.02101	98.0	1.49580	1.74875	-0.09284
8.0	0.02698	-15.68950	-17.53109	100.0	1.47786	1.69634	-0.14526
10.0	0.04205	-13.76273	-15.60432	102.0	1.45616	1.63208	-0.20951
12.0	0.06035	-12.19313	-14.03472	104.0	1.43082	1.55585	-0.28574
14.0	0.08183	-10.87086	-12.71245	106.0	1.40201	1.46750	-0.37409
16.0	0.10641	-9.73037	-11.57196	108.0	1.36989	1.36685	-0.47474
18.0	0.13399	-8.72940	-10.57099	110.0	1.33466	1.25369	-0.58790
20.0	0.16447	-7.83912	-9.68071	112.0	1.29652	1.12778	-0.71381
22.0	0.19774	-7.03898	-8.88057	114.0	1.25569	0.98884	-0.85275
24.0	0.23368	-6.31384	-8.15543	116.0	1.21242	0.83654	-1.00505
26.0	0.27213	-5.65221	-7.49380	118.0	1.16695	0.67052	-1.17108
28.0	0.31295	-5.04520	-6.88679	120.0	1.11953	0.49035	-1.35124
30.0	0.35598	-4.48577	-6.32736	122.0	1.07042	0.29556	-1.54603
32.0	0.40103	-3.96826	-5.80985	124.0	1.01991	0.08560	-1.75599
34.0	0.44791	-3.48807	-5.32966	126.0	0.96824	-0.14015	-1.98174
36.0	0.49643	-3.04142	-4.88301	128.0	0.91572	-0.38239	-2.22398
38.0	0.54637	-2.62515	-4.46674	130.0	0.86259	-0.64194	-2.48353
40.0	0.59750	-2.23659	-4.07818	132.0	0.80915	-0.91972	-2.76131
42.0	0.64960	-1.87352	-3.71511	134.0	0.75565	-1.21679	-3.05838
44.0	0.70242	-1.53402	-3.37561	136.0	0.70236	-1.53438	-3.37597
46.0	0.75571	-1.21644	-3.05803	138.0	0.64955	-1.87390	-3.71549
48.0	0.80921	-0.91938	-2.76097	140.0	0.59745	-2.23698	-4.07857
50.0	0.86266	-0.64161	-2.48320	142.0	0.54632	-2.62554	-4.46713
52.0	0.91578	-0.38207	-2.22366	144.0	0.49638	-3.04183	-4.88342
54.0	0.96831	-0.13984	-1.98143	146.0	0.44787	-3.48849	-5.33008
56.0	1.01997	0.08589	-1.75570	148.0	0.40099	-3.96868	-5.81027
58.0	1.07049	0.29584	-1.54576	150.0	0.35594	-4.48619	-6.32778
60.0	1.11960	0.49061	-1.35098	152.0	0.31292	-5.04563	-6.88722
62.0	1.16701	0.67076	-1.17083	154.0	0.27210	-5.65265	-7.49424
64.0	1.21249	0.83677	-1.00482	156.0	0.23365	-6.31428	-8.15587
66.0	1.25576	0.98906	-0.85254	158.0	0.19772	-7.03943	-8.88102
68.0	1.29658	1.12798	-0.71361	160.0	0.16445	-7.83957	-9.68117
70.0	1.33471	1.25388	-0.58771	162.0	0.13397	-8.72986	-10.57145
72.0	1.36994	1.36702	-0.47457	164.0	0.10639	-9.73084	-11.57243
74.0	1.40205	1.46765	-0.37394	166.0	0.08182	-10.87133	-12.71292
76.0	1.43086	1.55598	-0.28561	168.0	0.06034	-12.19360	-14.03519
78.0	1.45619	1.63219	-0.20940	170.0	0.04204	-13.76320	-15.60479
80.0	1.47789	1.69643	-0.14516	172.0	0.02698	-15.68997	-17.53156
82.0	1.49583	1.74882	-0.09277	174.0	0.01521	-18.17999	-20.02148
84.0	1.50990	1.78947	-0.05212	176.0	0.00677	-21.69541	-23.53700
86.0	1.52001	1.81845	-0.02314	178.0	0.00169	-27.71223	-29.55382
88.0	1.52609	1.83579	-0.00578	180.0	0.00000	-INFINITY	-INFINITY
90.0	1.52813	1.84159	0.0				

TABLE A1-4

INTEGRAL EQUATION METHOD
 EPSILON= 0.7500(NORMALIZED GROUNDPLANE RADIUS)
 MONOPOLE LENGTH= 0.250000(WAVELENGTH)
 INFINITELY THIN MONOPOLE RADIUS
 RADIATION RESISTANCE = 19.860252 (OHMS)

ELEVATION ANGLE (DEG)	DIRECTIVITY (NUMERIC)	DIRECTIVITY (DBI)	RELATIVE POWER (DB)	ELEVATION ANGLE (DEG)	DIRECTIVITY (NUMERIC)	DIRECTIVITY (DBI)	RELATIVE POWER (DB)
0	0.0000	-INFINITY	-INFINITY	92.0	1.50759	1.78283	-0.00553
2.0	0.00178	-27.49547	-29.28383	94.0	1.50189	1.76638	-0.02198
4.0	0.00711	-21.47962	-23.26798	96.0	1.49244	1.73897	-0.04939
6.0	0.01597	-17.96572	-19.75408	98.0	1.47929	1.70053	-0.08783
8.0	0.02833	-15.47805	-17.26641	100.0	1.46251	1.65098	-0.13738
10.0	0.04411	-13.55415	-15.34251	102.0	1.44218	1.59021	-0.19815
12.0	0.06327	-11.98804	-13.77640	104.0	1.41843	1.51807	-0.27029
14.0	0.08571	-10.66985	-12.45821	106.0	1.39136	1.43439	-0.35397
16.0	0.11133	-9.53401	-11.32237	108.0	1.36112	1.33897	-0.44939
18.0	0.14002	-8.53824	-10.32660	110.0	1.32788	1.23157	-0.55679
20.0	0.17164	-7.65369	-9.44205	112.0	1.29179	1.11193	-0.67643
22.0	0.20607	-6.85979	-8.64815	114.0	1.25306	0.97972	-0.80864
24.0	0.24314	-6.14135	-7.92971	116.0	1.21188	0.83459	-0.95377
26.0	0.28269	-5.48687	-7.27523	118.0	1.16846	0.67614	-1.11222
28.0	0.32453	-4.88740	-6.67576	120.0	1.12303	0.50391	-1.28445
30.0	0.36848	-4.33589	-6.12425	122.0	1.07582	0.31738	-1.47098
32.0	0.41432	-3.82663	-5.61499	124.0	1.02706	0.11597	-1.67239
34.0	0.46185	-3.35498	-5.14334	126.0	0.97702	-0.10099	-1.88935
36.0	0.51084	-2.91712	-4.70548	128.0	0.92592	-0.33424	-2.12260
38.0	0.56107	-2.50985	-4.29821	130.0	0.87405	-0.58465	-2.37301
40.0	0.61229	-2.13046	-3.91882	132.0	0.82164	-0.85319	-2.64155
42.0	0.66425	-1.77667	-3.56503	134.0	0.76896	-1.14095	-2.92931
44.0	0.71672	-1.44653	-3.23489	136.0	0.71627	-1.44921	-3.23757
46.0	0.76942	-1.13835	-2.92671	138.0	0.66383	-1.77942	-3.56778
48.0	0.82212	-0.85067	-2.63903	140.0	0.61189	-2.13327	-3.92163
50.0	0.87454	-0.58222	-2.37058	142.0	0.56070	-2.51273	-4.30109
52.0	0.92642	-0.33190	-2.12026	144.0	0.51050	-2.92006	-4.70842
54.0	0.97752	-0.09874	-1.88710	146.0	0.46153	-3.35798	-5.14634
56.0	1.02757	0.11813	-1.67023	148.0	0.41403	-3.82967	-5.61803
58.0	1.07633	0.31943	-1.46893	150.0	0.36822	-4.33898	-6.12734
60.0	1.12353	0.50586	-1.28250	152.0	0.32430	-4.89054	-6.67890
62.0	1.16895	0.67798	-1.11038	154.0	0.28248	-5.49005	-7.27841
64.0	1.21236	0.83631	-0.95205	156.0	0.24296	-6.14457	-7.93293
66.0	1.25352	0.98132	-0.80704	158.0	0.20592	-6.86304	-8.65140
68.0	1.29223	1.11341	-0.67495	160.0	0.17152	-7.65698	-9.44534
70.0	1.32829	1.23293	-0.55543	162.0	0.13991	-8.54155	-10.32991
72.0	1.36151	1.34020	-0.44816	164.0	0.11124	-9.53734	-11.32570
74.0	1.39171	1.43549	-0.35287	166.0	0.08564	-10.67320	-12.46156
76.0	1.41874	1.51904	-0.26932	168.0	0.06322	-11.99141	-13.77977
78.0	1.44246	1.59105	-0.19731	170.0	0.04408	-13.55754	-15.34590
80.0	1.46274	1.65168	-0.13668	172.0	0.02830	-15.48145	-17.26981
82.0	1.47948	1.70109	-0.08727	174.0	0.01596	-17.96913	-19.75749
84.0	1.49258	1.73939	-0.04897	176.0	0.00711	-21.48304	-23.27140
86.0	1.50199	1.76666	-0.02170	178.0	0.00178	-27.49889	-29.28725
88.0	1.50764	1.78297	-0.00539	180.0	0.00000	-INFINITY	-INFINITY
90.0	1.50951	1.78836	0.0				

TABLE A1-5

INTEGRAL EQUATION METHOD
 EPSILON= 1.0000(NORMALIZED GROUNDPLANE RADIUS)
 MONOPOLE LENGTH= 0.25000(WAVELENGTH)
 INFINITELY THIN MONOPOLE RADIUS
 RADIATION RESISTANCE = 20.227316 (OHMS)

ELEVATION ANGLE (DEG)	DIRECTIVITY (NUMERIC)	DIRECTIVITY (DBI)	RELATIVE POWER (DB)	ELEVATION ANGLE (DEG)	DIRECTIVITY (NUMERIC)	DIRECTIVITY (DBI)	RELATIVE POWER (DB)
0	0.00000	-INFINITY	-INFINITY	92	1.48032	1.70357	-0.00526
2	0.00191	-27.18126	-28.89009	94	1.47515	1.68837	-0.02046
4	0.00764	-21.16680	-22.87562	96	1.46662	1.66317	-0.04565
6	0.01716	-17.65519	-19.36402	98	1.45476	1.62791	-0.08091
8	0.03040	-15.17073	-16.87955	100	1.43962	1.58248	-0.12634
10	0.04731	-13.25092	-14.95975	102	1.42126	1.52675	-0.18208
12	0.06777	-11.68977	-13.39860	104	1.39976	1.46053	-0.24829
14	0.09168	-10.37740	-12.08622	106	1.37519	1.38364	-0.32518
16	0.11890	-9.24820	-10.95703	108	1.34767	1.29583	-0.41300
18	0.14928	-8.25987	-9.96869	110	1.31729	1.19682	-0.51200
20	0.18266	-7.38351	-9.09234	112	1.28419	1.08630	-0.62253
22	0.21885	-6.59853	-8.30735	114	1.24850	0.96390	-0.74492
24	0.25765	-5.88969	-7.59952	116	1.21038	0.82922	-0.87960
26	0.29885	-5.24545	-6.95428	118	1.16998	0.68180	-1.02703
28	0.34223	-4.65683	-6.36565	120	1.12749	0.52112	-1.18770
30	0.38755	-4.11669	-5.82551	122	1.08308	0.34661	-1.36222
32	0.43458	-3.61930	-5.32813	124	1.03696	0.15762	-1.55121
34	0.48306	-3.15997	-4.86880	126	0.98933	-0.04659	-1.75541
36	0.53275	-2.73480	-4.44363	128	0.94041	-0.26682	-1.97564
38	0.58337	-2.34054	-4.04936	130	0.89043	-0.50399	-2.21281
40	0.63468	-1.97442	-3.68325	132	0.83963	-0.75914	-2.46796
42	0.68642	-1.63411	-3.34294	134	0.78824	-1.03344	-2.74227
44	0.73832	-1.31757	-3.02640	136	0.73651	-1.32823	-3.03706
46	0.79012	-1.02307	-2.73189	138	0.68469	-1.64503	-3.35386
48	0.84158	-0.74907	-2.45789	140	0.63305	-1.98560	-3.69442
50	0.89243	-0.49424	-2.20306	142	0.58184	-2.35194	-4.06077
52	0.94245	-0.25740	-1.96623	144	0.53132	-2.74642	-4.45525
54	0.99139	-0.03753	-1.74636	146	0.48175	-3.17179	-4.88061
56	1.03903	0.16629	-1.54253	148	0.43338	-3.63131	-5.34013
58	1.08515	0.35489	-1.35393	150	0.38647	-4.12886	-5.83768
60	1.12953	0.52899	-1.17983	152	0.34126	-4.66915	-6.37797
62	1.17199	0.68924	-1.01959	154	0.29799	-5.25791	-6.96674
64	1.21233	0.83621	-0.87261	156	0.25690	-5.90228	-7.61111
66	1.25038	0.97042	-0.73840	158	0.21821	-6.61123	-8.32006
68	1.28598	1.09234	-0.61648	160	0.18212	-7.39632	-9.10514
70	1.31898	1.20237	-0.50646	162	0.14884	-8.27277	-9.98159
72	1.34923	1.30086	-0.40796	164	0.11854	-9.26118	-10.97000
74	1.37662	1.38815	-0.32067	166	0.09140	-10.39045	-12.09927
76	1.40104	1.46451	-0.24432	168	0.06756	-11.70288	-13.41171
78	1.42239	1.52017	-0.17865	170	0.04716	-13.26408	-14.97290
80	1.44057	1.58535	-0.12347	172	0.03031	-15.18392	-16.89275
82	1.45553	1.63022	-0.07861	174	0.01711	-17.66842	-19.37725
84	1.46720	1.66491	-0.04392	176	0.00762	-21.18005	-22.88887
86	1.47555	1.68953	-0.01930	178	0.00191	-27.19453	-28.90335
88	1.48052	1.70415	-0.00468	180	0.00000	-INFINITY	-INFINITY
90	1.48212	1.70883	0				

TABLE A1-6

INTEGRAL EQUATION METHOD
 FPSILDN= 1.2500(NORMALIZED GROUNDPLANE RADIUS)
 MONDPOLE LENGTH= 0.250000(WAVELENGTH)
 INITIALLY THIN MONDPOLE RADIUS
 RADIATION RESISTANCE = 20.756936 (OHMS)

ELEVATION ANGLE (DEG)	DIRECTIVITY (NUMERIC)	DIRECTIVITY (DBI)	RELATIVE POWER (DB)	ELEVATION ANGLE (DEG)	DIRECTIVITY (NUMERIC)	DIRECTIVITY (DBI)	RELATIVE POWER (DB)
0	0.00000	-INFINITY	-INFINITY	92	1.44259	1.59143	-0.00514
2	0.00211	-26.75595	-28.35253	94	1.43804	1.57772	-0.01886
4	0.00843	-20.74330	-22.33988	96	1.43066	1.55537	-0.04121
6	0.01890	-17.23472	-18.83129	98	1.42046	1.52429	-0.07228
8	0.03346	-14.75446	-16.35104	100	1.40746	1.48436	-0.11221
10	0.05200	-12.84004	-14.43662	102	1.39168	1.43540	-0.16117
12	0.07438	-11.28543	-12.88201	104	1.37316	1.37721	-0.21936
14	0.10044	-9.98072	-11.57730	106	1.35193	1.30953	-0.28705
16	0.13001	-8.86028	-10.45685	108	1.32803	1.23207	-0.36451
18	0.16286	-7.88176	-9.47834	110	1.30151	1.14448	-0.45209
20	0.19878	-7.01624	-8.61282	112	1.27245	1.04639	-0.55018
22	0.23752	-6.24306	-7.83963	114	1.24090	0.93737	-0.65921
24	0.27881	-5.54695	-7.14353	116	1.20696	0.81692	-0.77966
26	0.32238	-4.91631	-6.51289	118	1.17072	0.68452	-0.91206
28	0.36795	-4.34210	-5.93867	120	1.13228	0.53955	-1.05702
30	0.41523	-3.81712	-5.41370	122	1.09179	0.38137	-1.21520
32	0.46392	-3.33558	-4.93216	124	1.04936	0.20923	-1.38734
34	0.51372	-2.89272	-4.48929	126	1.00515	0.02232	-1.57425
36	0.56434	-2.48456	-4.08113	128	0.95934	-0.18026	-1.77684
38	0.61549	-2.10777	-3.70435	130	0.91211	-0.39854	-1.99612
40	0.66688	-1.75953	-3.35611	132	0.86365	-0.63664	-2.23321
42	0.71822	-1.43740	-3.03397	134	0.81418	-0.89281	-2.48939
44	0.76926	-1.13927	-2.73585	136	0.76393	-1.16949	-2.76606
46	0.81973	-0.86331	-2.45989	138	0.71313	-1.46828	-3.06486
48	0.86938	-0.60792	-2.20449	140	0.66206	-1.79103	-3.38761
50	0.91798	-0.37166	-1.96823	142	0.61096	-2.13984	-3.73642
52	0.96532	-0.15328	-1.74985	144	0.56013	-2.51714	-4.11372
54	1.01120	0.04836	-1.54822	146	0.50983	-2.92578	-4.52235
56	1.05542	0.23425	-1.36232	148	0.46035	-3.36907	-4.96565
58	1.09782	0.40532	-1.19126	150	0.41200	-3.85100	-5.44757
60	1.13825	0.56236	-1.03421	152	0.36506	-4.37632	-5.97290
62	1.17656	0.70613	-0.89045	154	0.31983	-4.95085	-6.54743
64	1.21263	0.83728	-0.75930	156	0.27658	-5.58177	-7.17835
66	1.24635	0.95641	-0.64016	158	0.23561	-6.27813	-7.87470
68	1.27764	1.06407	-0.53250	160	0.19717	-7.05153	-8.64810
70	1.30639	1.16074	-0.43584	162	0.16154	-7.91724	-9.51382
72	1.33256	1.24685	-0.34972	164	0.12895	-8.89593	-10.49250
74	1.35606	1.32280	-0.27377	166	0.09962	-10.01651	-11.61309
76	1.37687	1.38892	-0.20765	168	0.07377	-11.32134	-12.91792
78	1.39493	1.44552	-0.15106	170	0.05157	-12.7605	-14.47263
80	1.41021	1.49284	-0.10373	172	0.03319	-14.79056	-16.38713
82	1.42269	1.53111	-0.06546	174	0.01875	-17.27087	-18.86745
84	1.43235	1.56050	-0.03607	176	0.00836	-20.77950	-22.37607
86	1.43918	1.58115	-0.01543	178	0.00209	-26.79217	-28.38875
88	1.44316	1.59315	-0.00342	180	0.00000	-INFINITY	-INFINITY
90	1.44430	1.59658	0.0				

TABLE A1-7

INTEGRAL EQUATION METHOD
 FPSILDN= 1 5000(NORMALIZED GROUNDPLANE RADIUS)
 MONOPOLE LFNGTH= 0 250000(WAVELENGTH)
 INFINITELY THIN MONOPOLE RADIUS
 RADIATION RESISTANCE = 21.510639 (OHMS)

ELEVATION ANGLE (DEG)	DIRECTIVITY (NUMERIC)	DIRECTIVITY (DBI)	RELATIVE POWER (DB)	ELEVATION ANGLE (DEG)	DIRECTIVITY (NUMERIC)	DIRECTIVITY (DBI)	RELATIVE POWER (DB)
0	0 00000	-INFINITY	-INFINITY	92 0	1 39196	1 43626	-0 00541
2 0	0 00240	-26 20435	-27 64602	94 0	1 38808	1 42414	-0 01753
4 0	0 00956	-20 19397	-21 63564	96 0	1 38206	1 40525	-0 03642
6 0	0 02143	-16 68915	-18 13083	98 0	1 37388	1 37847	-0 06220
8 0	0 03790	-14 21416	-15 65583	100 0	1 36353	1 34663	-0 09504
10 0	0 05880	-12 30647	-13 74814	102 0	1 35099	1 30652	-0 13516
12 0	0 08395	-10 76003	-12 20171	104 0	1 33624	1 25884	-0 18283
14 0	0 11311	-9 46491	-10 90659	106 0	1 31926	1 20330	-0 23838
16 0	0 14603	-8 35545	-9 79712	108 0	1 30002	1 13950	-0 30218
18 0	0 18242	-7 38925	-8 83092	110 0	1 27850	1 06702	-0 37466
20 0	0 22196	-6 53734	-7 97901	112 0	1 25469	0 98538	-0 45630
22 0	0 26430	-5 77902	-7 22070	114 0	1 22858	0 89404	-0 54764
24 0	0 30910	-5 09897	-6 54064	116 0	1 20016	0 79241	-0 64927
26 0	0 35600	-4 48551	-5 92719	118 0	1 16945	0 67983	-0 76184
28 0	0 40462	-3 92955	-5 37123	120 0	1 13647	0 55559	-0 88608
30 0	0 45459	-3 42383	-4 86550	122 0	1 10126	0 41890	-1 02277
32 0	0 50554	-2 96246	-4 40413	124 0	1 06388	0 26891	-1 17277
34 0	0 55711	-2 54060	-3 98227	126 0	1 02439	0 10467	-1 33701
36 0	0 60895	-2 15421	-3 59588	128 0	0 98291	-0 07485	-1 51652
38 0	0 66072	-1 79986	-3 24153	130 0	0 93956	-0 27077	-1 71245
40 0	0 71209	-1 47462	-2 91630	132 0	0 89447	-0 48436	-1 92603
42 0	0 76279	-1 17598	-2 61765	134 0	0 84782	-0 71698	-2 15866
44 0	0 81251	-0 90171	-2 34339	136 0	0 79980	-0 97019	-2 41187
46 0	0 86102	-0 64989	-2 09156	138 0	0 75063	-1 24571	-2 68739
48 0	0 90808	-0 41878	-1 86046	140 0	0 70057	-1 54549	-2 98717
50 0	0 95348	-0 20686	-1 64854	142 0	0 64987	-1 87174	-3 31342
52 0	0 99707	-0 01275	-1 45443	144 0	0 59883	-2 22700	-3 66867
54 0	1 03867	0 16480	-1 27688	146 0	0 54775	-2 61419	-4 05587
56 0	1 07818	0 32691	-1 11477	148 0	0 49696	-3 03676	-4 47844
58 0	1 11548	0 47461	-0 96706	150 0	0 44681	-3 49876	-4 94044
60 0	1 15049	0 60885	-0 83283	152 0	0 39765	-4 00504	-5 44671
62 0	1 18317	0 73047	-0 71121	154 0	0 34983	-4 56148	-6 00315
64 0	1 21346	0 84027	-0 60141	156 0	0 30371	-5 17535	-6 61702
66 0	1 24135	0 93895	-0 50272	158 0	0 25967	-5 85575	-7 29743
68 0	1 26683	1 02719	-0 41448	160 0	0 21805	-6 61438	-8 05605
70 0	1 28991	1 10558	-0 33609	162 0	0 17920	-7 46654	-8 90822
72 0	1 31059	1 17467	-0 26701	164 0	0 14345	-8 43296	-9 87464
74 0	1 32890	1 23493	-0 20674	166 0	0 11111	-9 54261	-10 98428
76 0	1 34488	1 28688	-0 15485	168 0	0 08245	-10 83787	-12 27955
78 0	1 35854	1 33072	-0 11095	170 0	0 05775	-12 38443	-13 82610
80 0	1 36992	1 36697	-0 07471	172 0	0 03722	-14 29221	-15 73388
82 0	1 37906	1 39585	-0 04583	174 0	0 02105	-16 76728	-18 20895
84 0	1 38599	1 41760	-0 02408	176 0	0 00939	-20 27214	-21 71381
86 0	1 39072	1 43240	-0 00927	178 0	0 00235	-26 28255	-27 72422
88 0	1 39329	1 44040	-0 00127	180 0	0 00000	-INFINITY	-INFINITY
90 0	1 39369	1 44167	0 0				

TABLE A1-8

INTEGRAL EQUATION METHOD
 EPSILON= 1.7500(NORMALIZED GROUNDPLANE RADIUS)
 MONOPOLE LENGTH= 0.25000(WAVELENGTH)
 INFINITELY THIN MONOPOLE RADIUS
 RADIATION RESISTANCE = 22.587827 (OHMS)

ELEVATION ANGLE (DEG)	DIRECTIVITY (NUMERIC)	DIRECTIVITY (DBI)	RELATIVE POWER (DB)	ELEVATION ANGLE (DEG)	DIRECTIVITY (NUMERIC)	DIRECTIVITY (DBI)	RELATIVE POWER (DB)
0	0.00000	-INFINITY	-INFINITY	92.0	1.32528	1.22307	-0.00863
2.0	0.00281	-25.51382	-26.74553	94.0	1.32207	1.21253	-0.01918
4.0	0.01120	-19.50615	-20.73786	96.0	1.31757	1.19775	-0.03396
6.0	0.02509	-16.00584	-17.23755	98.0	1.31177	1.17858	-0.05313
8.0	0.04429	-13.53714	-14.76885	100.0	1.30460	1.15478	-0.07692
10.0	0.06859	-11.63751	-12.86921	102.0	1.29601	1.12608	-0.10563
12.0	0.09770	-10.10087	-11.33258	104.0	1.28590	1.09209	-0.13962
14.0	0.13130	-8.81726	-10.04897	106.0	1.27420	1.05238	-0.17933
16.0	0.16901	-7.72098	-8.95269	108.0	1.26080	1.00646	-0.22525
18.0	0.21040	-6.76961	-8.00132	110.0	1.24559	0.95376	-0.27795
20.0	0.25503	-5.93411	-7.16582	112.0	1.22847	0.89365	-0.33806
22.0	0.30243	-5.19374	-6.42545	114.0	1.20933	0.82544	-0.40627
24.0	0.35212	-4.53312	-5.76483	116.0	1.18806	0.74837	-0.48334
26.0	0.40360	-3.94052	-5.17223	118.0	1.16456	0.66162	-0.57009
28.0	0.45638	-3.40676	-4.63847	120.0	1.13876	0.56431	-0.66740
30.0	0.50997	-2.92451	-4.15522	122.0	1.11057	0.45547	-0.77624
32.0	0.56392	-2.48782	-3.71953	124.0	1.07996	0.33407	-0.89763
34.0	0.61777	-2.09175	-3.32346	126.0	1.04689	0.19902	-1.03269
36.0	0.67109	-1.73217	-2.96388	128.0	1.01137	0.04911	-1.18260
38.0	0.72351	-1.40556	-2.63727	130.0	0.97343	-0.11696	-1.34866
40.0	0.77466	-1.10889	-2.34059	132.0	0.93113	-0.30058	-1.53229
42.0	0.82423	-0.83951	-2.07122	134.0	0.89057	-0.50331	-1.73502
44.0	0.87194	-0.59511	-1.82582	136.0	0.84590	-0.72682	-1.95853
46.0	0.91757	-0.37363	-1.60534	138.0	0.79928	-0.97299	-2.20470
48.0	0.96090	-0.17322	-1.40493	140.0	0.75095	-1.24390	-2.47560
50.0	1.00180	0.00779	-1.22391	142.0	0.70115	-1.54188	-2.77359
52.0	1.04014	0.17093	-1.06078	144.0	0.65019	-1.86960	-3.10131
54.0	1.07586	0.31756	-0.91414	146.0	0.59840	-2.23011	-3.46182
56.0	1.10892	0.44899	-0.78272	148.0	0.54614	-2.62694	-3.85865
58.0	1.13930	0.56639	-0.66532	150.0	0.49383	-3.06426	-4.29597
60.0	1.16704	0.67085	-0.56085	152.0	0.44187	-3.54701	-4.77872
62.0	1.19218	0.76341	-0.46830	154.0	0.39074	-4.08116	-5.31287
64.0	1.21479	0.84501	-0.38670	156.0	0.34087	-4.67407	-5.90578
66.0	1.23496	0.91653	-0.31517	158.0	0.29276	-5.33491	-6.56662
68.0	1.25280	0.97881	-0.25290	160.0	0.24686	-6.07544	-7.30715
70.0	1.26841	1.03261	-0.19910	162.0	0.20366	-6.91104	-8.14275
72.0	1.28192	1.07863	-0.15308	164.0	0.16359	-7.86248	-9.09419
74.0	1.29345	1.11751	-0.11419	166.0	0.12709	-8.95880	-10.19051
76.0	1.30313	1.14986	-0.08185	168.0	0.09457	-10.24242	-11.47413
78.0	1.31105	1.17619	-0.05551	170.0	0.06639	-11.77905	-13.01076
80.0	1.31734	1.19698	-0.03473	172.0	0.04287	-13.67868	-14.91038
82.0	1.32209	1.21262	-0.01909	174.0	0.02428	-16.14737	-17.37937
84.0	1.32539	1.22345	-0.00825	176.0	0.01085	-19.64766	-20.87937
86.0	1.32732	1.22975	-0.00196	178.0	0.00272	-25.65532	-26.88703
88.0	1.32792	1.23171	0.0	180.0	0.00000	-INFINITY	-INFINITY
90.0	1.32723	1.22946	-0.00224				

TABLE A1-9

INTEGRAL EQUATION METHOD
 EPSILON= 2.0000(NORMALIZED GROUNDPLANE RADIUS)
 MONOPOLE LENGTH= 0.250000(WAVELENGTH)
 INFINITELY THIN MONOPOLE RADIUS
 RADIATION RESISTANCE = 24.149264 (OHMS)

ELEVATION ANGLE (DEG)	DIRECTIVITY (NUMERIC)	DIRECTIVITY (DBI)	RELATIVE POWER (DB)	ELEVATION ANGLE (DEG)	DIRECTIVITY (NUMERIC)	DIRECTIVITY (DBI)	RELATIVE POWER (DB)
0	0.00000	-INFINITY	-INFINITY	92.0	1.23900	0.93071	-0.03729
2.0	0.00340	-24.68049	-25.64850	94.0	1.23640	0.92158	-0.04642
4.0	0.01356	-18.67593	-19.64394	96.0	1.23358	0.91168	-0.05632
6.0	0.03033	-15.18081	-16.14882	98.0	1.23050	0.90080	-0.06720
8.0	0.05346	-12.71934	-13.68735	100.0	1.22705	0.88863	-0.07938
10.0	0.08262	-10.82898	-11.79699	102.0	1.22314	0.87475	-0.09326
12.0	0.11739	-9.30363	-10.27164	104.0	1.21861	0.85864	-0.10937
14.0	0.15728	-8.03330	-9.00130	106.0	1.21331	0.83970	-0.12830
16.0	0.20173	-6.95225	-7.92025	108.0	1.20705	0.81723	-0.15077
18.0	0.25015	-6.01801	-6.98602	110.0	1.19963	0.79046	-0.17755
20.0	0.30189	-5.20153	-6.16953	112.0	1.19083	0.75852	-0.20949
22.0	0.35629	-4.48200	-5.45000	114.0	1.18045	0.72047	-0.24753
24.0	0.41267	-3.84398	-4.81199	116.0	1.16824	0.67533	-0.29267
26.0	0.47036	-3.27570	-4.24371	118.0	1.15399	0.62203	-0.34598
28.0	0.52870	-2.76790	-3.73591	120.0	1.13748	0.55942	-0.40859
30.0	0.58706	-2.31320	-3.28121	122.0	1.11849	0.48632	-0.48169
32.0	0.64483	-1.90555	-2.87356	124.0	1.09684	0.40145	-0.56656
34.0	0.70146	-1.53995	-2.50795	126.0	1.07238	0.30348	-0.66452
36.0	0.75646	-1.21216	-2.18017	128.0	1.04496	0.19100	-0.77701
38.0	0.80936	-0.91858	-1.88658	130.0	1.01449	0.06250	-0.90551
40.0	0.85979	-0.65606	-1.62407	132.0	0.98093	-0.08364	-1.05164
42.0	0.90743	-0.42187	-1.38987	134.0	0.94425	-0.24912	-1.21713
44.0	0.95202	-0.21355	-1.18156	136.0	0.90452	-0.43582	-1.40383
46.0	0.99336	-0.02893	-0.99594	138.0	0.86183	-0.64578	-1.61378
48.0	1.03133	0.13398	-0.83402	140.0	0.81635	-0.88122	-1.84922
50.0	1.06586	0.27701	-0.69100	142.0	0.76831	-1.14463	-2.11264
52.0	1.09694	0.40181	-0.56619	144.0	0.71799	-1.43882	-2.40683
54.0	1.12459	0.50996	-0.45805	146.0	0.66574	-1.76695	-2.73496
56.0	1.14892	0.60290	-0.36510	148.0	0.61197	-2.13268	-3.10068
58.0	1.17004	0.68202	-0.28599	150.0	0.55715	-2.54026	-3.50827
60.0	1.18812	0.74861	-0.21940	152.0	0.50179	-2.99476	-3.96277
62.0	1.20334	0.80389	-0.16412	154.0	0.44645	-3.50223	-4.47024
64.0	1.21592	0.84905	-0.11896	156.0	0.39173	-4.07011	-5.03811
66.0	1.22608	0.88519	-0.08282	158.0	0.33825	-4.70765	-5.67566
68.0	1.23406	0.91337	-0.05463	160.0	0.28664	-5.42668	-6.39468
70.0	1.24011	0.93461	-0.03340	162.0	0.23754	-6.24284	-7.21065
72.0	1.24447	0.94983	-0.01817	164.0	0.19159	-7.17636	-8.14437
74.0	1.24737	0.95994	-0.00807	166.0	0.14939	-8.25692	-9.22493
76.0	1.24903	0.96575	-0.00226	168.0	0.11151	-9.52680	-10.49481
78.0	1.24969	0.96801	0.0	170.0	0.07849	-11.05174	-12.01975
80.0	1.24951	0.96740	-0.00061	172.0	0.05080	-12.94176	-13.90976
82.0	1.24868	0.96453	-0.00348	174.0	0.02882	-15.40295	-16.37095
84.0	1.24735	0.95990	-0.00811	176.0	0.01289	-18.86587	-19.86587
86.0	1.24564	0.95393	-0.01408	178.0	0.00323	-24.90230	-25.87031
88.0	1.24364	0.94695	-0.02106	180.0	0.00000	-INFINITY	-INFINITY
90.0	1.24141	0.93917	-0.02884				

TABLE A1-10

INTEGRAL EQUATION METHOD
 EPSILON= 2.2500(NORMALIZED GROUNDPLANE RADIUS)
 MONDPLE LENGTH= 0.250000(WAVELENGTH)
 INFINITELY THIN MONDPOLE RADIUS
 RADIATION RESISTANCE = 26.457698 (DHMS)

ELEVATION ANGLE (DEG)	DIRECTIVITY (NUMERIC)	DIRECTIVITY (DBI)	RELATIVE POWER (DB)	ELEVATION ANGLE (DEG)	DIRECTIVITY (NUMERIC)	DIRECTIVITY (DBI)	RELATIVE POWER (DB)
0	0.00000	-INFINITY	-INFINITY	92.0	1.12995	0.53060	-0.31591
2.0	0.00425	-23.71543	-24.56194	94.0	1.12788	0.52264	-0.32387
4.0	0.01693	-17.71432	-18.56083	96.0	1.12686	0.51869	-0.32782
6.0	0.03780	-14.22493	-15.07145	98.0	1.12680	0.51846	-0.32805
8.0	0.06650	-11.77148	-12.61799	100.0	1.12759	0.52150	-0.32501
10.0	0.10253	-9.89140	-10.73791	102.0	1.12907	0.52720	-0.31931
12.0	0.14526	-8.37857	-9.22508	104.0	1.13104	0.53478	-0.31173
14.0	0.19396	-7.12297	-7.96949	106.0	1.13328	0.54336	-0.30316
16.0	0.24781	-6.05885	-6.90536	108.0	1.13551	0.55190	-0.29461
18.0	0.30594	-5.14370	-5.99031	110.0	1.13744	0.55928	-0.28723
20.0	0.36742	-4.34841	-5.19493	112.0	1.13875	0.56427	-0.28224
22.0	0.43130	-3.65216	-4.49857	114.0	1.13909	0.56558	-0.28093
24.0	0.49666	-3.03945	-3.88596	116.0	1.13811	0.56183	-0.28469
26.0	0.56254	-2.49845	-3.34496	118.0	1.13542	0.55158	-0.29493
28.0	0.62808	-2.01985	-2.86637	120.0	1.13067	0.53336	-0.31316
30.0	0.69243	-1.59622	-2.44273	122.0	1.12347	0.50562	-0.34089
32.0	0.75484	-1.22143	-2.06794	124.0	1.11347	0.46679	-0.37973
34.0	0.81463	-0.89041	-1.73693	126.0	1.10033	0.41522	-0.43129
36.0	0.87119	-0.59886	-1.44538	128.0	1.08374	0.34923	-0.49728
38.0	0.92404	-0.34309	-1.18960	130.0	1.06342	0.28706	-0.57946
40.0	0.97278	-0.11985	-0.96637	132.0	1.03917	0.16686	-0.67966
42.0	1.01711	0.07368	-0.77284	134.0	1.01081	0.04669	-0.79982
44.0	1.05683	0.24005	-0.60646	136.0	0.97825	-0.09550	-0.94201
46.0	1.09184	0.38158	-0.46493	138.0	0.94147	-0.26192	-1.10844
48.0	1.12212	0.50037	-0.34614	140.0	0.90054	-0.45499	-1.30150
50.0	1.14773	0.59839	-0.24812	142.0	0.85560	-0.67732	-1.52383
52.0	1.16881	0.67746	-0.16906	144.0	0.80689	-0.93184	-1.77835
54.0	1.18558	0.73930	-0.10721	146.0	0.75477	-1.22185	-2.06837
56.0	1.19828	0.78558	-0.06093	148.0	0.69966	-1.55112	-2.39764
58.0	1.20722	0.81786	-0.02865	150.0	0.64209	-1.92401	-2.77053
60.0	1.21274	0.83768	-0.00883	152.0	0.58269	-2.34566	-3.19217
62.0	1.21521	0.84651	0.0	154.0	0.52213	-2.82221	-3.66872
64.0	1.21501	0.84580	-0.00071	156.0	0.46119	-3.36117	-4.20768
66.0	1.21254	0.83696	-0.00955	158.0	0.40069	-3.97187	-4.81838
68.0	1.20819	0.82136	-0.02516	160.0	0.34149	-4.66619	-5.51270
70.0	1.20235	0.80032	-0.04619	162.0	0.28447	-5.45963	-6.30615
72.0	1.19541	0.77515	-0.07136	164.0	0.23051	-6.37308	-7.21959
74.0	1.18771	0.74710	-0.09941	166.0	0.18048	-7.43565	-8.28216
76.0	1.17960	0.71734	-0.12917	168.0	0.13521	-8.68986	-9.53637
78.0	1.17138	0.68699	-0.15952	170.0	0.09547	-10.20148	-11.04800
80.0	1.16335	0.65709	-0.1942	172.0	0.06194	-12.08057	-12.92708
82.0	1.15573	0.62857	-0.21794	174.0	0.03521	-14.53323	-15.37974
84.0	1.14875	0.60225	-0.24426	176.0	0.01577	-18.02205	-18.86856
86.0	1.14257	0.57882	-0.26769	178.0	0.00396	-24.02282	-24.86933
88.0	1.13732	0.55884	-0.28768	180.0	0.00000	-INFINITY	-INFINITY
90.0	1.13310	0.54269	-0.30383				

TABLE A1-11

INTEGRAL EQUATION METHOD
 EPSILON= 2.500(NORMALIZED GROUNDPLANE RADIUS)
 MONOPOLE LENGTH= 0.250000(WAVELENGTH)
 INFINITELY THIN MONOPOLE RADIUS
 RADIATION RESISTANCE = 29.949409 (OHMS)

ELEVATION ANGLE (DEG)	DIRECTIVITY (NUMERIC)	DIRECTIVITY (DBI)	RELATIVE POWER (DB)	ELEVATION ANGLE (DEG)	DIRECTIVITY (NUMERIC)	DIRECTIVITY (DBI)	RELATIVE POWER (DB)
0	0.00000	-INFINITY	-INFINITY	92	0.99690	-0.01348	-1.00677
2	0.00544	-22.64798	-23.64127	94	0.99529	-0.02050	-1.01378
4	0.02162	-16.65057	-17.64385	96	0.99613	-0.01683	-1.01012
6	0.04822	-13.16734	-14.16062	98	0.99933	-0.00290	-0.99619
8	0.08467	-10.72249	-11.71577	100	1.00475	0.02059	-0.97270
10	0.13021	-8.85344	-9.84673	102	1.01220	0.05267	-0.94061
12	0.18390	-7.35407	-8.34735	104	1.02145	0.09215	-0.90113
14	0.24466	-6.11432	-7.10760	106	1.03219	0.13761	-0.85567
16	0.31129	-5.06840	-6.06168	108	1.04411	0.18748	-0.80581
18	0.38249	-4.17379	-5.16708	110	1.05683	0.24003	-0.75325
20	0.45694	-3.40136	-4.39465	112	1.06991	0.29346	-0.69982
22	0.53331	-2.73023	-3.72351	114	1.08290	0.34588	-0.64740
24	0.61026	-2.14487	-3.13815	116	1.09531	0.39536	-0.59792
26	0.68653	-1.63340	-2.62668	118	1.10661	0.43993	-0.55335
28	0.76094	-1.18648	-2.17977	120	1.11625	0.47762	-0.51566
30	0.83241	-0.79662	-1.78990	122	1.12369	0.50645	-0.48684
32	0.89999	-0.45764	-1.45093	124	1.12835	0.52443	-0.46886
34	0.96285	-0.16443	-1.15772	126	1.12968	0.52956	-0.46373
36	1.02032	0.08738	-0.90590	128	1.12715	0.51983	-0.47345
38	1.07190	0.30156	-0.69173	130	1.12027	0.49321	-0.50007
40	1.11722	0.48138	-0.51191	132	1.10856	0.44761	-0.54568
42	1.15605	0.62977	-0.36352	134	1.09166	0.38087	-0.61241
44	1.18832	0.74935	-0.24394	136	1.06924	0.29075	-0.70253
46	1.21409	0.84251	-0.15077	138	1.04109	0.17488	-0.81841
48	1.23352	0.91148	-0.08181	140	1.00710	0.03071	-0.96257
50	1.24690	0.95830	-0.03498	142	0.96727	-0.14451	-1.13779
52	1.25457	0.98495	-0.00834	144	0.92176	-0.35381	-1.34710
54	1.25698	0.99328	0.0	146	0.87084	-0.60060	-1.59389
56	1.25462	0.98513	-0.00815	148	0.81495	-0.88872	-1.88200
58	1.24803	0.96226	-0.03102	150	0.75464	-1.22260	-2.21589
60	1.23778	0.92642	-0.06686	152	0.69064	-1.60746	-2.60075
62	1.22444	0.87536	-0.11392	154	0.62380	-2.04951	-3.04280
64	1.20860	0.82282	-0.17047	156	0.55510	-2.55631	-3.54960
66	1.19084	0.75853	-0.23475	158	0.48560	-3.13724	-4.13053
68	1.17173	0.68827	-0.30502	160	0.41646	-3.80423	-4.79751
70	1.15180	0.61378	-0.37950	162	0.34891	-4.57282	-5.56610
72	1.13158	0.53685	-0.45643	164	0.28419	-5.45392	-6.45721
74	1.11154	0.45923	-0.53405	166	0.22353	-6.50670	-7.49999
76	1.09211	0.38266	-0.61062	168	0.16812	-7.74370	-8.73698
78	1.07370	0.30882	-0.68446	170	0.11910	-9.24072	-10.23400
80	1.05665	0.23933	-0.75395	172	0.07749	-11.10782	-12.10110
82	1.04129	0.17570	-0.81759	174	0.04415	-13.55115	-14.54443
84	1.02785	0.11930	-0.87399	176	0.01980	-17.03329	-18.02657
86	1.01656	0.07132	-0.92196	178	0.00498	-23.03004	-24.02333
88	1.00757	0.03275	-0.96053	180	0.00000	-INFINITY	-INFINITY
90	1.00100	0.00433	-0.98896				

TABLE A1-12

INTEGRAL EQUATION METHOD
 EPSILON= 2.7500(NORMALIZED GROUNDPLANE RADIUS)
 MONDPOLE LENGTH= 0.250000(WAVELENGTH)
 INFINITELY THIN MONDPOLE RADIUS
 RADIATION RESISTANCE = 35.435753 (DHMS)

ELEVATION ANGLE (DEG)	DIRECTIVITY (NUMERIC)	DIRECTIVITY (DBI)	RELATIVE POWER (DB)	ELEVATION ANGLE (DEG)	DIRECTIVITY (NUMERIC)	DIRECTIVITY (DBI)	RELATIVE POWER (DB)
0	0.00000	-INFINITY	-INFINITY	92.0	0.83880	-0.76343	-2.15477
2.0	0.16697	-7.77357	-9.16490	94.0	0.83553	-0.78038	-2.17172
4.0	0.04084	-13.88912	-15.28045	96.0	0.83619	-0.77695	-2.16829
6.0	0.01774	-17.50997	-18.90130	98.0	0.84070	-0.75360	-2.14493
8.0	0.00974	-20.11249	-21.50383	100.0	0.84893	-0.71130	-2.10264
10.0	0.00608	-22.15993	-23.55127	102.0	0.86068	-0.65156	-2.04290
12.0	0.00411	-23.85916	-25.25049	104.0	0.87573	-0.57629	-1.96763
14.0	0.00294	-25.32105	-26.71238	106.0	0.89377	-0.48775	-1.87909
16.0	0.00218	-26.61237	-28.00370	108.0	0.91444	-0.38847	-1.77980
18.0	0.00167	-27.77678	-29.16812	110.0	0.93732	-0.28114	-1.67247
20.0	0.00130	-28.84480	-30.23614	112.0	0.96193	-0.16856	-1.55990
22.0	0.00104	-29.83895	-31.23028	114.0	0.98774	-0.05357	-1.44490
24.0	0.00084	-30.77677	-32.16810	116.0	1.01415	0.06103	-1.33031
26.0	0.00068	-31.67266	-33.06399	118.0	1.04051	0.17247	-1.21886
28.0	0.00056	-32.53914	-33.93047	120.0	1.06612	0.27807	-1.11326
30.0	0.00046	-33.38779	-34.77913	122.0	1.09024	0.37524	-1.01610
32.0	0.00038	-34.23011	-35.62144	124.0	1.11210	0.46145	-0.92989
34.0	0.00031	-35.07836	-36.46970	126.0	1.13090	0.53425	-0.85708
36.0	0.00025	-35.94670	-37.33804	128.0	1.14585	0.59127	-0.80007
38.0	0.00021	-36.85281	-38.24414	130.0	1.15615	0.63014	-0.76119
40.0	0.00017	-37.82054	-39.21187	132.0	1.16106	0.64853	-0.74280
42.0	0.00013	-38.88502	-40.27635	134.0	1.15986	0.64406	-0.74727
44.0	0.00010	-40.10317	-41.49450	136.0	1.15195	0.61432	-0.77701
46.0	0.00007	-41.57970	-42.97103	138.0	1.13678	0.55678	-0.83455
48.0	0.00004	-43.54736	-44.93870	140.0	1.11398	0.46878	-0.92255
50.0	0.00002	-46.74541	-48.13675	142.0	1.08329	0.34747	-1.04387
52.0	1.37763	1.39133	0.0	144.0	1.04465	0.18971	-1.20163
54.0	1.36140	1.33985	-0.05148	146.0	0.99817	-0.00796	-1.39930
56.0	1.33969	1.27006	-0.12128	148.0	0.94418	-0.24946	-1.64079
58.0	1.31335	1.18381	-0.20752	150.0	0.88323	-0.53928	-1.93061
60.0	1.28321	1.08298	-0.30836	152.0	0.81608	-0.88268	-2.27401
62.0	1.25010	0.96946	-0.42188	154.0	0.74372	-1.28592	-2.67726
64.0	1.21484	0.84520	-0.54614	156.0	0.66733	-1.75662	-3.14795
66.0	1.17821	0.71221	-0.67912	158.0	0.58828	-2.30418	-3.69551
68.0	1.14093	0.57260	-0.81873	160.0	0.50809	-2.94057	-4.33191
70.0	1.10371	0.42856	-0.96277	162.0	0.42841	-3.68138	-5.07271
72.0	1.06718	0.28239	-1.10895	164.0	0.35095	-4.54754	-5.93887
74.0	1.03192	0.13646	-1.25487	166.0	0.27744	-5.56824	-6.95957
76.0	0.99845	-0.00674	-1.39808	168.0	0.20960	-6.78605	-8.17739
78.0	0.96723	-0.14470	-1.53603	170.0	0.14905	-8.26680	-9.65814
80.0	0.93867	-0.27485	-1.66619	172.0	0.09726	-10.12057	-11.51190
82.0	0.91312	-0.39470	-1.78603	174.0	0.05555	-12.55350	-13.94484
84.0	0.89087	-0.50184	-1.89317	176.0	0.02496	-16.02821	-17.41954
86.0	0.87216	-0.59404	-1.98537	178.0	0.00628	-22.02051	-23.41184
88.0	0.85716	-0.66936	-2.06069	180.0	0.00000	-INFINITY	-INFINITY
90.0	0.84602	-0.72621	-2.11754				

TABLE A1-13

INTEGRAL EQUATION METHOD
 EPSILON= 3.0000(NORMALIZED GROUNDPLANE RADIUS)
 MONOPOLE LENGTH= 0.250000(WAVELENGTH)
 INFINITELY THIN MONOPOLE RADIUS
 RADIATION RESISTANCE = 44.598673 (OHMS)

ELEVATION ANGLE (DEG)	DIRECTIVITY (NUMERIC)	DIRECTIVITY (DBI)	RELATIVE POWER (DB)	ELEVATION ANGLE (DEG)	DIRECTIVITY (NUMERIC)	DIRECTIVITY (DBI)	RELATIVE POWER (DB)
0	0.00000	-INFINITY	-INFINITY	92.0	0.00007	-41.44714	-42.30817
2.0	0.26737	-5.72891	-6.58995	94.0	0.00006	-42.32503	-43.18607
4.0	0.06676	-11.75511	-12.61614	96.0	0.00004	-43.47261	-44.33365
6.0	0.02964	-15.28085	-16.14189	98.0	0.00003	-45.12107	-45.98211
8.0	0.01666	-17.78195	-18.64298	100.0	0.00002	-48.00829	-48.86933
10.0	0.01066	-19.72094	-20.58197	102.0	0.67468	-1.70899	-2.57002
12.0	0.00741	-21.30390	-22.16494	104.0	0.69294	-1.59303	-2.45407
14.0	0.00544	-22.64081	-23.50185	106.0	0.71581	-1.45200	-2.31303
16.0	0.00417	-23.79734	-24.65838	108.0	0.74299	-1.29018	-2.15121
18.0	0.00330	-24.81589	-25.67693	110.0	0.77408	-1.11214	-1.97317
20.0	0.00268	-25.72545	-26.58649	112.0	0.80863	-0.92250	-1.78353
22.0	0.00221	-26.54673	-27.40776	114.0	0.84610	-0.72580	-1.58683
24.0	0.00186	-27.29504	-28.15607	116.0	0.88586	-0.52636	-1.38740
26.0	0.00159	-27.98207	-28.84310	118.0	0.92720	-0.32827	-1.18930
28.0	0.00138	-28.61692	-29.47795	120.0	0.96932	-0.13531	-0.99634
30.0	0.00120	-29.20685	-30.06788	122.0	1.01135	0.04902	-0.81201
32.0	0.00106	-29.75775	-30.61878	124.0	1.05232	0.22148	-0.63956
34.0	0.00094	-30.27448	-31.13551	126.0	1.09120	0.37906	-0.48197
36.0	0.00084	-30.76111	-31.62214	128.0	1.12692	0.51894	-0.34210
38.0	0.00075	-31.22109	-32.08212	130.0	1.15836	0.63843	-0.22260
40.0	0.00068	-31.65739	-32.51842	132.0	1.18439	0.73494	-0.12609
42.0	0.00062	-32.07261	-32.93364	134.0	1.20391	0.80593	-0.05510
44.0	0.00057	-32.46903	-33.33007	136.0	1.21586	0.84883	-0.01220
46.0	0.00052	-32.84870	-33.70974	138.0	1.21928	0.86103	0.0
48.0	0.00048	-33.21348	-34.07452	140.0	1.21333	0.83979	-0.02124
50.0	0.00044	-33.56508	-34.42611	142.0	1.19735	0.78220	-0.07883
52.0	0.00041	-33.90509	-34.76613	144.0	1.17087	0.68509	-0.17594
54.0	0.00038	-34.23504	-35.09607	146.0	1.13370	0.54497	-0.31607
56.0	0.00035	-34.55638	-35.41741	148.0	1.08589	0.35788	-0.50316
58.0	0.00033	-34.87057	-35.73160	150.0	1.02785	0.11930	-0.74173
60.0	0.00030	-35.17904	-36.04008	152.0	0.96028	-0.17604	-1.03707
62.0	0.00028	-35.48329	-36.34432	154.0	0.88421	-0.53442	-1.39546
64.0	0.00026	-35.78486	-36.64589	156.0	0.80104	-0.96348	-1.82451
66.0	0.00025	-36.08539	-36.94643	158.0	0.71242	-1.47265	-2.33368
68.0	0.00023	-36.38670	-37.24773	160.0	0.62031	-2.07391	-2.93494
70.0	0.00021	-36.69077	-37.55180	162.0	0.52688	-2.78287	-3.64390
72.0	0.00020	-36.99987	-37.86090	164.0	0.43446	-3.62048	-4.48151
74.0	0.00019	-37.31664	-38.17768	166.0	0.34547	-4.61594	-5.47697
76.0	0.00017	-37.64420	-38.50523	168.0	0.26231	-5.81185	-6.67288
78.0	0.00016	-37.98631	-38.84735	170.0	0.18733	-7.27404	-8.13507
80.0	0.00015	-38.34765	-39.20868	172.0	0.12267	-9.11260	-9.97363
82.0	0.00013	-38.73414	-39.59517	174.0	0.07025	-11.53370	-12.39473
84.0	0.00012	-39.15351	-40.01454	176.0	0.03162	-14.99895	-15.86098
86.0	0.00011	-39.61614	-40.47718	178.0	0.00797	-20.98716	-21.84820
88.0	0.00010	-40.13656	-40.99760	180.0	0.00000	-INFINITY	-INFINITY
90.0	0.00008	-40.73596	-41.59699				

TABLE A1-14

INTEGRAL EQUATION METHOD
 EPSILON= 0.0 (NORMALIZED GROUNDPLANE RADIUS)
 MONOPOLE LENGTH= 0.10000(WAVELENGTH)
 INFINITELY THIN MONOPOLE RADIUS
 RADIATION RESISTANCE = 2.100720 (OHMS)

ELEVATION ANGLE θ (DEG)	DIRECTIVITY (NUMERIC)	DIRECTIVITY (DBI)	RELATIVE POWER (DB)	ELEVATION ANGLE (DEG)	DIRECTIVITY (NUMERIC)	DIRECTIVITY (DBI)	RELATIVE POWER (DB)
0.	0.00000	-INFINITY	-INFINITY	92.0	1.50475	1.77464	-0.00541
2.0	0.00179	-27.45943	-29.23947	94.0	1.49913	1.75840	-0.02165
4.0	0.00717	-21.44377	-23.22382	96.0	1.48980	1.73129	-0.04876
6.0	0.01611	-17.93019	-19.71033	98.0	1.47681	1.69324	-0.08680
8.0	0.02856	-15.44296	-17.22301	100.0	1.46022	1.64418	-0.13586
10.0	0.04447	-13.51963	-15.29987	102.0	1.44012	1.58399	-0.19606
12.0	0.06376	-11.95420	-13.73424	104.0	1.41661	1.51252	-0.26753
14.0	0.08636	-10.63680	-12.41685	106.0	1.38982	1.42960	-0.35045
16.0	0.11215	-9.50187	-11.28191	108.0	1.35988	1.33502	-0.44503
18.0	0.14102	-8.50711	-10.28715	110.0	1.32695	1.22855	-0.55150
20.0	0.17284	-7.62366	-9.40370	112.0	1.29119	1.10991	-0.67014
22.0	0.20745	-6.83094	-8.61098	114.0	1.25279	0.97879	-0.80126
24.0	0.24469	-6.11377	-7.89381	116.0	1.21194	0.83482	-0.94522
26.0	0.28441	-5.46063	-7.24087	118.0	1.16886	0.67761	-1.10244
28.0	0.32639	-4.86257	-6.64262	120.0	1.12375	0.50669	-1.27336
30.0	0.37047	-4.31251	-6.09256	122.0	1.07684	0.32153	-1.45852
32.0	0.41641	-3.80476	-5.58481	124.0	1.02838	0.12154	-1.65850
34.0	0.46402	-3.33466	-5.11471	126.0	0.97860	-0.09393	-1.87398
36.0	0.51305	-2.89837	-4.67842	128.0	0.92776	-0.32566	-2.10571
38.0	0.56329	-2.49268	-4.27273	130.0	0.87609	-0.57450	-2.35455
40.0	0.61448	-2.11490	-3.89494	132.0	0.82387	-0.84143	-2.62147
42.0	0.66639	-1.76271	-3.54276	134.0	0.77134	-1.12756	-2.90760
44.0	0.71876	-1.43416	-3.21421	136.0	0.71876	-1.43416	-3.21421
46.0	0.77134	-1.12756	-2.90760	138.0	0.66639	-1.76271	-3.54276
48.0	0.82387	-0.84143	-2.62147	140.0	0.61448	-2.11490	-3.89494
50.0	0.87609	-0.57450	-2.35455	142.0	0.56329	-2.49268	-4.27273
52.0	0.92776	-0.32566	-2.10571	144.0	0.51305	-2.89837	-4.67842
54.0	0.97860	-0.09393	-1.87398	146.0	0.46402	-3.33466	-5.11471
56.0	1.02838	0.12154	-1.65850	148.0	0.41641	-3.80476	-5.58481
58.0	1.07684	0.32153	-1.45852	150.0	0.37047	-4.31251	-6.09256
60.0	1.12375	0.50669	-1.27336	152.0	0.32639	-4.86257	-6.64262
62.0	1.16886	0.67761	-1.10244	154.0	0.28441	-5.46063	-7.24087
64.0	1.21194	0.83482	-0.94522	156.0	0.24469	-6.11377	-7.89381
66.0	1.25279	0.97879	-0.80126	158.0	0.20745	-6.83094	-8.61098
68.0	1.29119	1.10991	-0.67014	160.0	0.17284	-7.62366	-9.40370
70.0	1.32695	1.22855	-0.55150	162.0	0.14102	-8.50711	-10.28715
72.0	1.35988	1.33502	-0.44503	164.0	0.11215	-9.50187	-11.28191
74.0	1.38982	1.42960	-0.35045	166.0	0.08636	-10.63680	-12.41685
76.0	1.41661	1.51252	-0.26753	168.0	0.06376	-11.95420	-13.73424
78.0	1.44012	1.58399	-0.19606	170.0	0.04447	-13.51963	-15.29987
80.0	1.46022	1.64418	-0.13586	172.0	0.02856	-15.44296	-17.22301
82.0	1.47681	1.69324	-0.08680	174.0	0.01611	-17.93019	-19.71033
84.0	1.48980	1.73129	-0.04876	176.0	0.00717	-21.44377	-23.22382
86.0	1.49913	1.75840	-0.02165	178.0	0.00179	-27.45943	-29.23947
88.0	1.50475	1.77464	-0.00541	180.0	0.00000	-INFINITY	-INFINITY
90.0	1.50662	1.78005	0.0				

TABLE A1-15

INTEGRAL EQUATION METHOD
 EPSILON= 0.250(NORMALIZED GROUNDPLANE RADIUS)
 MONOPDLE LENGTH= 0.100000(WAVELENGTH)
 INFINITELY THIN MONOPDLE RADIUS
 RADIATION RESISTANCE = 2.105873 (DHMS)

ELEVATION ANGLE (DEG)	DIRECTIVITY (NUMERIC)	DIRECTIVITY (DBI)	RELATIVE POWER (DB)	ELEVATION ANGLE (DEG)	DIRECTIVITY (NUMERIC)	DIRECTIVITY (DBI)	RELATIVE POWER (DB)
0	0.00000	-INFINITY	-INFINITY	92	1.50109	1.76406	-0.00534
2	0.00181	-27.41673	-29.18613	94	1.49555	1.74802	-0.02139
4	0.00724	-21.40126	-23.17067	96	1.48636	1.72123	-0.04818
6	0.01626	-17.88800	-19.65741	98	1.47355	1.68364	-0.08577
8	0.02883	-15.40123	-17.17064	100	1.45719	1.63515	-0.13425
10	0.04489	-13.47847	-15.24788	102	1.43736	1.57566	-0.19375
12	0.06436	-11.91374	-13.68315	104	1.41417	1.50500	-0.26441
14	0.08715	-10.59716	-12.36657	106	1.38772	1.42301	-0.34640
16	0.11316	-9.46316	-11.23257	108	1.35815	1.32948	-0.43993
18	0.14225	-8.46944	-10.23885	110	1.32561	1.22415	-0.54526
20	0.17430	-7.58714	-9.35654	112	1.29026	1.10676	-0.66265
22	0.20914	-6.79567	-8.56507	114	1.25227	0.97698	-0.79243
24	0.24661	-6.07984	-7.84925	116	1.21184	0.83444	-0.93496
26	0.28654	-5.42813	-7.19753	118	1.16916	0.67874	-1.09067
28	0.32873	-4.83158	-6.60098	120	1.12445	0.50939	-1.26002
30	0.37298	-4.28310	-6.05251	122	1.07792	0.32588	-1.44353
32	0.41908	-3.77699	-5.54640	124	1.02982	0.12760	-1.64181
34	0.46681	-3.30860	-5.07800	126	0.98036	-0.08613	-1.85554
36	0.51593	-2.87406	-4.64347	128	0.92981	-0.31607	-2.08547
38	0.56622	-2.47016	-4.23957	130	0.87840	-0.56308	-2.33249
40	0.61742	-2.09420	-3.86361	132	0.82639	-0.82816	-2.59757
42	0.66929	-1.74386	-3.51327	134	0.77403	-1.11243	-2.88184
44	0.72158	-1.41717	-3.18658	136	0.72158	-1.41718	-3.18658
46	0.77403	-1.11243	-2.88184	138	0.66929	-1.74387	-3.51327
48	0.82639	-0.82816	-2.59757	140	0.61742	-2.09421	-3.86361
50	0.87840	-0.56308	-2.33249	142	0.56622	-2.47017	-4.23958
52	0.92981	-0.31606	-2.08547	144	0.51593	-2.87406	-4.64347
54	0.98036	-0.08613	-1.85553	146	0.46681	-3.30860	-5.07801
56	1.02982	0.12760	-1.64181	148	0.41908	-3.77400	-5.54641
58	1.07792	0.32588	-1.44353	150	0.37298	-4.28311	-6.05251
60	1.12445	0.50940	-1.26001	152	0.32873	-4.83158	-6.60099
62	1.16916	0.67874	-1.09067	154	0.28654	-5.42813	-7.19754
64	1.21184	0.83445	-0.93496	156	0.24661	-6.07985	-7.84925
66	1.25227	0.97698	-0.79243	158	0.20914	-6.79567	-8.56508
68	1.29026	1.10676	-0.66264	160	0.17430	-7.58714	-9.35655
70	1.32561	1.22415	-0.54255	162	0.14225	-8.46945	-10.23885
72	1.35815	1.32948	-0.43993	164	0.11316	-9.46316	-11.23257
74	1.38772	1.42301	-0.34639	166	0.08715	-10.59717	-12.36657
76	1.41417	1.50500	-0.26440	168	0.06436	-11.91374	-13.68315
78	1.43736	1.57566	-0.19375	170	0.04489	-13.47848	-15.24788
80	1.45719	1.63516	-0.13425	172	0.02883	-15.40123	-17.17064
82	1.47355	1.68364	-0.08577	174	0.01626	-17.88801	-19.65742
84	1.48636	1.72123	-0.04818	176	0.00724	-21.40127	-23.17068
86	1.49555	1.74802	-0.02139	178	0.00181	-27.41673	-29.18614
88	1.50109	1.76406	-0.00534	180	0.00000	-INFINITY	-INFINITY
90	1.50294	1.76941	0				

TABLE A1-16

INTEGRAL EQUATION METHOD
 $\epsilon_{\text{FSL}} = 0.5000$ (NORMALIZED GROUNDPLANE RADIUS)
 MONOPOLE LENGTH = 0.100000 (WAVELENGTH)
 INFINITELY THIN MONOPOLE RADIUS
 RADIATION RESISTANCE = 2.120811 (OHMS)

ELEVATION ANGLE (DEG)	DIRECTIVITY (NUMERIC)	DIRECTIVITY (DBI)	RELATIVE POWER (DB)	ELEVATION ANGLE (DEG)	DIRECTIVITY (NUMERIC)	DIRECTIVITY (DBI)	RELATIVE POWER (DB)
0	0.00000	-INFINITY	-INFINITY	92.0	1.49058	1.73355	-0.00516
2.0	0.00186	-27.29481	-29.03352	94.0	1.48527	1.71806	-0.02065
4.0	0.00745	-21.27990	-23.01861	96.0	1.47645	1.69220	-0.04651
6.0	0.01672	-17.76756	-19.50627	98.0	1.46417	1.65590	-0.08281
8.0	0.02963	-15.28207	-17.02078	100.0	1.44846	1.60907	-0.12964
10.0	0.04612	-13.36095	-15.09666	102.0	1.42941	1.55158	-0.18713
12.0	0.06610	-11.79820	-13.53691	104.0	1.40711	1.48327	-0.25544
14.0	0.08946	-10.48395	-12.22266	106.0	1.38164	1.40395	-0.33476
16.0	0.11608	-9.35260	-11.09131	108.0	1.35313	1.31341	-0.42530
18.0	0.14582	-8.36185	-10.10056	110.0	1.32171	1.21137	-0.52733
20.0	0.17853	-7.48281	-9.22152	112.0	1.28753	1.09756	-0.64115
22.0	0.21405	-6.69430	-8.43360	114.0	1.25073	0.97163	-0.76708
24.0	0.25218	-5.98289	-7.72160	116.0	1.21149	0.83318	-0.90552
26.0	0.29274	-5.33524	-7.07395	118.0	1.16998	0.68180	-1.05691
28.0	0.33551	-4.74299	-6.48170	120.0	1.12642	0.51699	-1.22172
30.0	0.38028	-4.19902	-5.93773	122.0	1.08098	0.33819	-1.40052
32.0	0.42681	-3.69761	-5.43632	124.0	1.03390	0.14478	-1.59392
34.0	0.47489	-3.23407	-4.97278	126.0	0.98539	-0.06393	-1.80264
36.0	0.52426	-2.80453	-4.54324	128.0	0.93568	-0.28874	-2.02745
38.0	0.57468	-2.40575	-4.14446	130.0	0.88501	-0.53054	-2.26925
40.0	0.62589	-2.03500	-3.77371	132.0	0.83362	-0.79034	-2.52905
42.0	0.67765	-1.68993	-3.42864	134.0	0.78176	-1.06929	-2.80800
44.0	0.72970	-1.36856	-3.10727	136.0	0.72967	-1.36871	-3.10742
46.0	0.78178	-1.06915	-2.80786	138.0	0.67763	-1.69009	-3.42880
48.0	0.83364	-0.79020	-2.52891	140.0	0.62587	-2.03516	-3.77386
50.0	0.88503	-0.53040	-2.26911	142.0	0.57466	-2.40592	-4.14462
52.0	0.93571	-0.28861	-2.02732	144.0	0.52424	-2.80470	-4.54341
54.0	0.98542	-0.06380	-1.80251	146.0	0.47487	-3.23424	-4.97295
56.0	1.03393	0.14490	-1.59381	148.0	0.42680	-3.69778	-5.43649
58.0	1.08101	0.33830	-1.40041	150.0	0.38026	-4.19920	-5.93791
60.0	1.12644	0.51709	-1.22162	152.0	0.33549	-4.74317	-6.48188
62.0	1.17001	0.68190	-1.05681	154.0	0.29272	-5.3543	-7.07414
64.0	1.21151	0.83328	-0.90543	156.0	0.25217	-5.98307	-7.72178
66.0	1.25075	0.97171	-0.76700	158.0	0.21404	-6.69509	-8.43379
68.0	1.28755	1.09764	-0.64107	160.0	0.17853	-7.48301	-9.22172
70.0	1.32174	1.21145	-0.52726	162.0	0.14581	-8.36204	-10.10075
72.0	1.35315	1.31347	-0.42524	164.0	0.11607	-9.35280	-11.09151
74.0	1.38166	1.40401	-0.33470	166.0	0.08945	-10.48415	-12.22286
76.0	1.40712	1.48332	-0.25539	168.0	0.06609	-11.79840	-13.53711
78.0	1.42943	1.55162	-0.18709	170.0	0.04612	-13.36115	-15.09986
80.0	1.44847	1.60911	-0.12960	172.0	0.02963	-15.28227	-17.02098
82.0	1.46418	1.65593	-0.08278	174.0	0.01672	-17.76777	-19.50647
84.0	1.47646	1.69222	-0.04619	176.0	0.00745	-21.28010	-23.01881
86.0	1.48528	1.71807	-0.02064	178.0	0.00186	-27.29501	-29.03372
88.0	1.49058	1.73356	-0.00515	180.0	0.00000	-INFINITY	-INFINITY
90.0	1.49235	1.73871	0.0				

TABLE A1-17

INTEGRAL EQUATION METHOD
 EPSILON= 0.7500(NORMALIZED GROUNDPLANE RADIUS)
 MONOPOLE LENGTH= 0.10000(WAVELENGTH)
 INFINITELY THIN MONOPOLE RADIUS
 RADIATION RESISTANCE = 2.146484 (OHMS)

ELEVATION ANGLE (DEG)	DIRECTIVITY (NUMERIC)	DIRECTIVITY (DBI)	RELATIVE POWER (DB)	ELEVATION ANGLE (DEG)	DIRECTIVITY (NUMERIC)	DIRECTIVITY (DBI)	RELATIVE POWER (DB)
0	0.00000	-INFINITY	-INFINITY	92.0	1.47285	1.68158	-0.00487
2.0	0.00195	-27.09141	-28.77786	94.0	1.46792	1.66702	-0.01943
4.0	0.00780	-21.07742	-22.76387	96.0	1.45973	1.64271	-0.04374
6.0	0.01751	-17.56660	-19.25305	98.0	1.44830	1.60859	-0.07787
8.0	0.03102	-15.08323	-16.76968	100.0	1.43368	1.56453	-0.12192
10.0	0.04625	-13.16482	-14.85127	102.0	1.41593	1.51041	-0.17604
12.0	0.06910	-11.60536	-13.29181	104.0	1.39510	1.44605	-0.24040
14.0	0.09345	-10.29495	-11.98140	106.0	1.37127	1.37124	-0.31521
16.0	0.12112	-9.16799	-10.85444	108.0	1.34454	1.28573	-0.40072
18.0	0.15198	-8.18215	-9.86860	110.0	1.31500	1.18925	-0.49721
20.0	0.18584	-7.30853	-8.99498	112.0	1.28276	1.08146	-0.60500
22.0	0.22251	-6.52650	-8.21295	114.0	1.24796	0.96199	-0.72446
24.0	0.26177	-5.82083	-7.50728	116.0	1.21072	0.83044	-0.85601
26.0	0.30339	-5.17994	-6.86639	118.0	1.17120	0.68632	-1.00013
28.0	0.34715	-4.59483	-6.28128	120.0	1.12957	0.52912	-1.15733
30.0	0.39279	-4.05835	-5.74480	122.0	1.08598	0.35824	-1.32822
32.0	0.44007	-3.56475	-5.25120	124.0	1.04064	0.17301	-1.51344
34.0	0.48873	-3.10930	-4.79575	126.0	0.99374	-0.02729	-1.71374
36.0	0.53851	-2.68609	-4.37454	128.0	0.94547	-0.24351	-1.92996
38.0	0.58914	-2.29785	-3.98430	130.0	0.89607	-0.47558	-2.16303
40.0	0.64036	-1.93579	-3.62224	132.0	0.84576	-0.72755	-2.41400
42.0	0.69190	-1.59954	-3.28599	134.0	0.79476	-0.99762	-2.68407
44.0	0.74352	-1.28705	-2.97350	136.0	0.74334	-1.28814	-2.97459
46.0	0.79496	-0.99657	-2.68302	138.0	0.69173	-1.60066	-3.28711
48.0	0.84595	-0.72653	-2.41298	140.0	0.64019	-1.93694	-3.62339
50.0	0.89627	-0.47560	-2.16205	142.0	0.58897	-2.29303	-3.98549
52.0	0.94568	-0.24257	-1.92902	144.0	0.53836	-2.68931	-4.37576
54.0	0.99394	-0.02639	-1.71284	146.0	0.48859	-3.11054	-4.79699
56.0	1.04085	0.17387	-1.51258	148.0	0.43995	-3.56602	-5.25247
58.0	1.08619	0.35905	-1.32740	150.0	0.39268	-4.05964	-5.74609
60.0	1.12977	0.52989	-1.15656	152.0	0.34705	-4.59614	-6.28259
62.0	1.17140	0.68705	-0.99940	154.0	0.30330	-5.18127	-6.86772
64.0	1.21091	0.83112	-0.85533	156.0	0.26169	-5.82218	-7.50863
66.0	1.24814	0.96263	-0.72383	158.0	0.22244	-6.52787	-8.21432
68.0	1.28293	1.08204	-0.60441	160.0	0.18578	-7.30992	-8.99637
70.0	1.31516	1.18978	-0.49667	162.0	0.15193	-8.18355	-9.87000
72.0	1.34469	1.28622	-0.40023	164.0	0.12108	-9.16940	-10.85586
74.0	1.37141	1.37167	-0.31478	166.0	0.09340	-10.29638	-11.98283
76.0	1.39522	1.44643	-0.24002	168.0	0.06908	-11.60679	-13.29324
78.0	1.41603	1.51074	-0.17571	170.0	0.04824	-13.16626	-14.85271
80.0	1.43377	1.56481	-0.12164	172.0	0.03101	-15.08468	-16.77113
82.0	1.44837	1.60881	-0.07765	174.0	0.01751	-17.56805	-19.25450
84.0	1.45978	1.64288	-0.04351	176.0	0.00780	-21.07887	-22.76533
86.0	1.46796	1.66713	-0.01932	178.0	0.00195	-27.09287	-28.77932
88.0	1.47287	1.68164	-0.00481	180.0	0.00000	-INFINITY	-INFINITY
90.0	1.47450	1.68645	0.0				

TABLE A1-18

INTEGRAL EQUATION METHOD
 EPSILON= 1.0000(NORMALIZED GROUNDPLANE RADIUS)
 MONOPOLE LENGTH= 0.100000(WAVELENGTH)
 INFINITELY THIN MONOPOLE RADIUS
 RADIATION RESISTANCE = 2.185235 (OHMS)

ELEVATION ANGLE (DEG)	DIRECTIVITY (NUMERIC)	DIRECTIVITY (DBI)	RELATIVE POWER (DB)	ELEVATION ANGLE (DEG)	DIRECTIVITY (NUMERIC)	DIRECTIVITY (DBI)	RELATIVE POWER (DB)
0	0.00000	-INFINITY	-INFINITY	92.0	1.44686	1.60426	-0.00449
2.0	0.00209	-26.79818	-28.40693	94.0	1.44245	1.59101	-0.01774
4.0	0.00835	-20.78549	-22.39424	96.0	1.43514	1.56894	-0.03980
6.0	0.01872	-17.27683	-18.88558	98.0	1.42494	1.53797	-0.07078
8.0	0.03314	-14.79647	-16.40522	100.0	1.41188	1.49797	-0.11078
10.0	0.05150	-12.88191	-14.49066	102.0	1.39597	1.44877	-0.15998
12.0	0.07367	-11.32713	-12.93587	104.0	1.37726	1.39017	-0.21857
14.0	0.09949	-10.02219	-11.63094	106.0	1.35580	1.32194	-0.28680
16.0	0.12878	-8.90148	-10.51023	108.0	1.33162	1.24380	-0.36495
18.0	0.16134	-7.92264	-9.53139	110.0	1.30479	1.15541	-0.45333
20.0	0.19694	-7.05674	-8.66549	112.0	1.27539	1.05642	-0.55233
22.0	0.23534	-6.28311	-7.89186	114.0	1.24348	0.94640	-0.66235
24.0	0.27628	-5.58649	-7.19524	116.0	1.20917	0.82489	-0.78386
26.0	0.31950	-4.95526	-6.56400	118.0	1.17256	0.69136	-0.91738
28.0	0.36472	-4.38036	-5.98911	120.0	1.13377	0.54524	-1.06351
30.0	0.41166	-3.85462	-5.46337	122.0	1.09292	0.38587	-1.22287
32.0	0.46002	-3.37222	-4.98097	124.0	1.05016	0.21254	-1.39621
34.0	0.50952	-2.92839	-4.53714	126.0	1.00564	0.02444	-1.58431
36.0	0.55987	-2.51917	-4.12791	128.0	0.95955	-0.17933	-1.78808
38.0	0.61077	-2.14121	-3.74996	130.0	0.91206	-0.39976	-2.00850
40.0	0.66196	-1.79168	-3.40043	132.0	0.86338	-0.63796	-2.24671
42.0	0.71315	-1.46816	-3.07691	134.0	0.81373	-0.89520	-2.50395
44.0	0.76409	-1.16853	-2.77728	136.0	0.76333	-1.17290	-2.78164
46.0	0.81452	-0.89097	-2.49572	138.0	0.71242	-1.47265	-3.08139
48.0	0.86420	-0.63387	-2.24262	140.0	0.66126	-1.79629	-3.40503
50.0	0.91289	-0.39581	-2.00455	142.0	0.61011	-2.14592	-3.75467
52.0	0.96039	-0.17553	-1.78428	144.0	0.55924	-2.52398	-4.13273
54.0	1.00649	0.02808	-1.58067	146.0	0.50894	-2.93331	-4.54205
56.0	1.05100	0.21602	-1.39273	148.0	0.45949	-3.37723	-4.98597
58.0	1.09375	0.38919	-1.21956	150.0	0.41118	-3.85971	-5.46846
60.0	1.13459	0.54838	-1.06037	152.0	0.36429	-4.38553	-5.99428
62.0	1.17336	0.69432	-0.91442	154.0	0.31912	-4.96050	-6.56925
64.0	1.20995	0.82766	-0.78108	156.0	0.27594	-5.59180	-7.20055
66.0	1.24422	0.94898	-0.65976	158.0	0.23505	-6.28849	-7.89724
68.0	1.27609	1.05881	-0.54994	160.0	0.19669	-7.06217	-8.67092
70.0	1.30545	1.15760	-0.45115	162.0	0.16113	-7.92813	-9.53687
72.0	1.33223	1.24578	-0.36297	164.0	0.12862	-8.90701	-10.51576
74.0	1.35635	1.32372	-0.28503	166.0	0.09936	-10.02776	-11.63651
76.0	1.37776	1.39173	-0.21701	168.0	0.07357	-11.33273	-12.94147
78.0	1.39640	1.45011	-0.15864	170.0	0.05143	-12.88754	-14.49629
80.0	1.41224	1.49909	-0.10906	172.0	0.03310	-14.80213	-16.41087
82.0	1.42524	1.53887	-0.06987	174.0	0.01870	-17.28250	-18.89125
84.0	1.43536	1.56962	-0.03913	176.0	0.00833	-20.79117	-22.39992
86.0	1.44260	1.59146	-0.01728	178.0	0.00209	-26.80387	-28.41262
88.0	1.44693	1.60449	-0.00426	180.0	0.00000	-INFINITY	-INFINITY
90.0	1.44835	1.60875	0.0				

TABLE A1-19

INTEGRAL EQUATION METHOD
 EPSILON= 1.2500(NORMALIZED GROUNDPLANE RADIUS)
 MONOPOLE LENGTH= 0.100000(WAVELENGTH)
 INFINITELY THIN MONOPOLE RADIUS
 RADIATION RESISTANCE = 2.241091 (DHMS)

ELEVATION ANGLE θ (DEG)	DIRECTIVITY (NUMERIC)	DIRECTIVITY (DBI)	RELATIVE POWER (OR)	ELEVATION ANGLE (DEG)	DIRECTIVITY (NUMERIC)	DIRECTIVITY (DBI)	RELATIVE POWER (DB)
0	0.00000	-INFINITY	-INFINITY	92.0	1.41094	1.49508	-0.00405
2.0	0.00229	-26.40280	-27.90193	94.0	1.40720	1.48357	-0.01557
4.0	0.00914	-20.39182	-21.89095	96.0	1.40105	1.46453	-0.03461
6.0	0.02048	-16.88601	-18.38515	98.0	1.39247	1.43786	-0.06128
8.0	0.03623	-14.40963	-15.90877	100.0	1.38147	1.40340	-0.09573
10.0	0.05623	-12.50016	-13.99929	102.0	1.36803	1.36097	-0.13816
12.0	0.08032	-10.95154	-12.45068	104.0	1.35217	1.31032	-0.18882
14.0	0.10830	-9.65385	-11.15298	106.0	1.33388	1.25116	-0.24798
16.0	0.13991	-8.54141	-10.04054	108.0	1.31315	1.18315	-0.31598
18.0	0.17491	-7.57184	-9.07098	110.0	1.29001	1.10592	-0.39321
20.0	0.21300	-6.71618	-8.21531	112.0	1.26446	1.01903	-0.48010
22.0	0.25388	-5.95371	-7.45284	114.0	1.23652	0.92200	-0.57713
24.0	0.29723	-5.26911	-6.76825	116.0	1.20623	0.81429	-0.68485
26.0	0.34271	-4.65073	-6.14887	118.0	1.17362	0.69529	-0.80384
28.0	0.38999	-4.08947	-5.58860	120.0	1.13877	0.56435	-0.93479
30.0	0.43873	-3.57806	-5.07720	122.0	1.10172	0.42073	-1.07841
32.0	0.48858	-3.11065	-4.60978	124.0	1.06258	0.26363	-1.23551
34.0	0.53921	-2.68239	-4.18152	126.0	1.02145	0.09216	-1.40698
36.0	0.59030	-2.28925	-3.78839	128.0	0.97844	-0.09466	-1.59380
38.0	0.64153	-1.92783	-3.42696	130.0	0.93370	-0.29792	-1.79706
40.0	0.69260	-1.59521	-3.09434	132.0	0.88740	-0.51882	-2.01795
42.0	0.74321	-1.28888	-2.78801	134.0	0.83971	-0.75870	-2.25783
44.0	0.79311	-1.00666	-2.50579	136.0	0.79085	-1.01906	-2.51820
46.0	0.84205	-0.74663	-2.24577	138.0	0.74104	-1.30160	-2.80073
48.0	0.88979	-0.50711	-2.00825	140.0	0.69052	-1.60823	-3.10736
50.0	0.93614	-0.28660	-1.78573	142.0	0.63957	-1.94113	-3.44027
52.0	0.98090	-0.08374	-1.58288	144.0	0.58846	-2.30282	-3.80195
54.0	1.02392	0.10266	-1.39648	146.0	0.53750	-2.69620	-4.19533
56.0	1.06505	0.27369	-1.22545	148.0	0.48700	-3.12468	-4.62382
58.0	1.10416	0.43033	-1.06881	150.0	0.43729	-3.59230	-5.09144
60.0	1.14116	0.57346	-0.92567	152.0	0.38870	-4.10390	-5.60304
62.0	1.17595	0.70390	-0.79523	154.0	0.34156	-4.66535	-6.16448
64.0	1.20848	0.82238	-0.67675	156.0	0.29622	-5.28389	-6.78302
66.0	1.23867	0.92955	-0.56958	158.0	0.25301	-5.96862	-7.46776
68.0	1.26649	1.02603	-0.47311	160.0	0.21226	-6.73123	-8.23036
70.0	1.29191	1.11234	-0.38680	162.0	0.17430	-7.58701	-9.08615
72.0	1.31491	1.18897	-0.31016	164.0	0.13942	-8.55668	-10.05582
74.0	1.33548	1.25637	-0.24276	166.0	0.10791	-9.66921	-11.16834
76.0	1.35360	1.31491	-0.18422	168.0	0.08004	-10.96698	-12.45612
78.0	1.36928	1.36493	-0.13420	170.0	0.05603	-12.51566	-14.01480
80.0	1.38252	1.40672	-0.09241	172.0	0.03610	-14.42519	-15.92432
82.0	1.39332	1.44052	-0.05861	174.0	0.02041	-16.90161	-18.40075
84.0	1.40169	1.46653	-0.03260	176.0	0.00910	-20.40745	-21.90658
86.0	1.40764	1.48191	-0.01423	178.0	0.00228	-26.41844	-27.91758
88.0	1.41116	1.49575	-0.00338	180.0	0.00000	-INFINITY	-INFINITY
90.0	1.41226	1.49913	0.0				

TABLE A1-20

INTEGRAL EQUATION METHOD
 EPSILON= 1.5000(NORMALIZED GROUNDPLANE RADIUS)
 MONOPOLE LENGTH= 0.100000(WAVELENGTH)
 INFINITELY THIN MONOPOLE RADIUS
 RADIATION RESISTANCE = 2.320740 (OHMS)

ELEVATION ANGLE (DEG)	DIRECTIVITY (NUMERIC)	DIRECTIVITY (DBI)	RELATIVE POWER (DB)	ELEVATION ANGLE (DEG)	DIRECTIVITY (NUMERIC)	DIRECTIVITY (DBI)	RELATIVE POWER (DB)
0	0.00000	-INFINITY	-INFINITY	92.0	1.36255	1.34383	-0.00363
2.0	0.00258	-25.89000	-27.23747	94.0	1.35973	1.33453	-0.01293
4.0	0.01028	-19.88119	-21.22865	96.0	1.35503	1.31948	-0.02799
6.0	0.02302	-16.37897	-17.72644	98.0	1.34851	1.29854	-0.04893
8.0	0.04067	-13.90760	-15.25506	100.0	1.34014	1.27151	-0.07595
10.0	0.06303	-12.00453	-13.35200	102.0	1.32989	1.23817	-0.10930
12.0	0.08987	-10.46371	-11.81118	104.0	1.31771	1.19819	-0.14927
14.0	0.12092	-9.17516	-10.52262	106.0	1.30354	1.15123	-0.19624
16.0	0.15584	-8.07318	-9.42064	108.0	1.28732	1.09686	-0.25060
18.0	0.19430	-7.11535	-8.46281	110.0	1.26900	1.03463	-0.31284
20.0	0.23590	-6.27266	-7.62012	112.0	1.24853	0.96399	-0.38348
22.0	0.28026	-5.52435	-6.87182	114.0	1.22585	0.88436	-0.46310
24.0	0.32696	-4.85506	-6.20253	116.0	1.20091	0.79510	-0.55236
26.0	0.37557	-4.25307	-5.60053	118.0	1.17368	0.69550	-0.65197
28.0	0.42568	-3.70920	-5.05666	120.0	1.14414	0.58477	-0.76269
30.0	0.47685	-3.21614	-4.56361	122.0	1.11226	0.46208	-0.88538
32.0	0.52869	-2.76795	-4.11541	124.0	1.07808	0.32650	-1.02097
34.0	0.58080	-2.35972	-3.70718	126.0	1.04160	0.17701	-1.17045
36.0	0.63280	-1.98732	-3.33478	128.0	1.00289	0.01254	-1.33493
38.0	0.68434	-1.64726	-2.99473	130.0	0.96202	-0.16814	-1.51561
40.0	0.73510	-1.33655	-2.68401	132.0	0.91911	-0.36634	-1.71380
42.0	0.78477	-1.05257	-2.40004	134.0	0.87428	-0.58351	-1.93097
44.0	0.83310	-0.79305	-2.14051	136.0	0.82770	-0.82127	-2.16873
46.0	0.87984	-0.55596	-1.90343	138.0	0.77958	-1.08142	-2.42888
48.0	0.92480	-0.33952	-1.68698	140.0	0.73013	-1.36597	-2.71344
50.0	0.96781	-0.14210	-1.48956	142.0	0.67964	-1.67722	-3.02468
52.0	1.00873	0.03775	-1.30972	144.0	0.62838	-2.01777	-3.36523
54.0	1.04745	0.20134	-1.14612	146.0	0.57668	-2.39061	-3.73808
56.0	1.08390	0.34988	-0.99758	148.0	0.52490	-2.79526	-4.14672
58.0	1.11801	0.48447	-0.86300	150.0	0.47339	-3.24782	-4.59529
60.0	1.14977	0.60610	-0.74136	152.0	0.42255	-3.74122	-5.08868
62.0	1.17915	0.71572	-0.63175	154.0	0.37279	-4.28540	-5.63286
64.0	1.20619	0.81416	-0.53331	156.0	0.32451	-4.88767	-6.23513
66.0	1.23089	0.90220	-0.44527	158.0	0.27815	-5.55720	-6.90467
68.0	1.25330	0.98055	-0.36692	160.0	0.23411	-6.30573	-7.65319
70.0	1.27346	1.04986	-0.29760	162.0	0.19281	-7.14861	-8.49608
72.0	1.29144	1.11073	-0.23674	164.0	0.15465	-8.10661	-9.45407
74.0	1.30728	1.16367	-0.18379	166.0	0.11998	-9.20873	-10.55620
76.0	1.32105	1.20918	-0.13829	168.0	0.08918	-10.49741	-11.84487
78.0	1.33280	1.24766	-0.09981	170.0	0.06254	-12.03834	-13.38560
80.0	1.34260	1.27948	-0.06799	172.0	0.04035	-13.94148	-15.28895
82.0	1.35050	1.30494	-0.04250	174.0	0.02284	-16.41292	-17.76039
84.0	1.35653	1.32430	-0.02316	176.0	0.01020	-19.91518	-21.26264
86.0	1.36074	1.33776	-0.00971	178.0	0.00256	-25.92402	-27.27149
88.0	1.36315	1.34545	-0.00202	180.0	0.00000	-INFINITY	-INFINITY
90.0	1.36379	1.34746	0.0				

TABLE A1-21

INTEGRAL EQUATION METHOD
 EPSILON= 1.7500(NORMALIZED GROUNDPLANE RADIUS)
 MONOPOLE LENGTH= 0.10000(WAVELENGTH)
 INFINITELY THIN MONOPOLE RADIUS
 RADIATION RESISTANCE = 2.435146 (OHMS)

ELEVATION ANGLE (DEG)	DIRECTIVITY (NUMERIC)	DIRECTIVITY (DBI)	RELATIVE POWER (DB)	ELEVATION ANGLE (DEG)	DIRECTIVITY (NUMERIC)	DIRECTIVITY (DBI)	RELATIVE POWER (DB)
0	0.00000	-INFINITY	-INFINITY	92.0	1.29873	1.13520	-0.00337
2.0	0.00299	-25.24498	-26.38355	94.0	1.29679	1.12869	-0.00988
4.0	0.01192	-19.23878	-20.37735	96.0	1.29385	1.11885	-0.01972
6.0	0.02666	-15.74092	-16.87949	98.0	1.28948	1.10550	-0.03306
8.0	0.04704	-13.27562	-14.41419	100.0	1.28481	1.08839	-0.05017
10.0	0.07277	-11.38034	-12.51890	102.0	1.27855	1.06719	-0.07137
12.0	0.10354	-9.84898	-10.98754	104.0	1.27101	1.04151	-0.09706
14.0	0.13895	-8.57154	-9.71010	106.0	1.26208	1.01086	-0.12771
16.0	0.17855	-7.48229	-8.62086	108.0	1.25162	0.97472	-0.16385
18.0	0.22188	-6.53879	-7.67735	110.0	1.23950	0.93248	-0.20609
20.0	0.26841	-5.71195	-6.85052	112.0	1.22559	0.88346	-0.25510
22.0	0.31762	-4.98099	-6.11955	114.0	1.20974	0.82694	-0.31163
24.0	0.36894	-4.33047	-5.46904	116.0	1.19182	0.76209	-0.37647
26.0	0.42183	-3.74862	-4.88718	118.0	1.17167	0.68806	-0.45050
28.0	0.47575	-3.22620	-4.36476	120.0	1.14919	0.60390	-0.53466
30.0	0.53017	-2.75582	-3.89439	122.0	1.12424	0.50861	-0.62996
32.0	0.58459	-2.33146	-3.47003	124.0	1.09675	0.40109	-0.73748
34.0	0.63854	-1.94813	-3.08670	126.0	1.06564	0.28017	-0.85839
36.0	0.69157	-1.60161	-2.74018	128.0	1.03386	0.14461	-0.99396
38.0	0.74331	-1.28831	-2.42688	130.0	0.99840	-0.00696	-1.14553
40.0	0.79339	-1.00514	-2.14370	132.0	0.96028	-0.17601	-1.31458
42.0	0.84152	-0.74936	-1.88793	134.0	0.91957	-0.36414	-1.50271
44.0	0.88744	-0.51859	-1.65716	136.0	0.87637	-0.57310	-1.71167
46.0	0.93096	-0.31069	-1.44926	138.0	0.83084	-0.80483	-1.94339
48.0	0.97191	-0.12372	-1.26229	140.0	0.78317	-1.06146	-2.20003
50.0	1.01020	0.04405	-1.09451	142.0	0.73360	-1.34541	-2.48398
52.0	1.04574	0.19423	-0.94434	144.0	0.68243	-1.65940	-2.79797
54.0	1.07852	0.32828	-0.81029	146.0	0.63001	-2.00653	-3.14510
56.0	1.10855	0.44755	-0.69102	148.0	0.57671	-2.39041	-3.52898
58.0	1.13587	0.55330	-0.58527	150.0	0.52297	-2.81525	-3.95382
60.0	1.16056	0.64668	-0.49189	152.0	0.46924	-3.28605	-4.42462
62.0	1.18271	0.72879	-0.40977	154.0	0.41602	-3.80885	-4.94741
64.0	1.20244	0.80064	-0.33793	156.0	0.36383	-4.39102	-5.52959
66.0	1.21988	0.86316	-0.27540	158.0	0.31320	-5.04182	-6.18039
68.0	1.23516	0.91724	-0.22133	160.0	0.26467	-5.77302	-6.91159
70.0	1.24844	0.96367	-0.17490	162.0	0.21877	-6.60007	-7.73863
72.0	1.25985	1.00320	-0.13537	164.0	0.17605	-7.54375	-8.68232
74.0	1.26955	1.03651	-0.10206	166.0	0.13699	-8.63314	-9.77171
76.0	1.27768	1.06421	-0.07436	168.0	0.10208	-9.91070	-11.04927
78.0	1.28436	1.08686	-0.05171	170.0	0.07174	-11.44216	-12.58073
80.0	1.28971	1.10492	-0.03364	172.0	0.04637	-13.33752	-14.47609
82.0	1.29385	1.11882	-0.01974	174.0	0.02629	-15.80288	-16.94145
84.0	1.29685	1.12890	-0.00967	176.0	0.01175	-19.30078	-20.43935
86.0	1.29880	1.13541	-0.00315	178.0	0.00295	-25.30701	-26.44558
88.0	1.29974	1.13857	0.0	180.0	0.00000	-INFINITY	-INFINITY
90.0	1.29971	1.13848	-0.00094				

TABLE A1-22

INTEGRAL EQUATION METHOD
 EPSILON= 2.0000(NORMALIZED GROUNDPLANE RADIUS)
 MONOPOLE LENGTH= 0.100000(WAVELENGTH)
 INFINITELY THIN MONOPOLE RADIUS
 RADIATION RESISTANCE = 2.602246 (DHMS)

ELEVATION ANGLE (DEG)	DIRECTIVITY (NUMERIC)	DIRECTIVITY (DBI)	RELATIVE POWER (DB)	ELEVATION ANGLE (DEG)	DIRECTIVITY (NUMERIC)	DIRECTIVITY (DBI)	RELATIVE POWER (DB)
0	0.00000	-INFINITY	-INFINITY	92	1.21539	0.84716	-0.01889
2	0.00358	-24.45939	-25.32544	94	1.21457	0.84422	-0.02183
4	0.01427	-18.45624	-19.32230	96	1.21375	0.84128	-0.02477
6	0.03189	-14.56346	-15.82951	98	1.21286	0.83809	-0.02796
8	0.05617	-12.50525	-13.37131	100	1.21180	0.83429	-0.03176
10	0.08671	-10.61906	-11.48511	102	1.21044	0.82943	-0.03662
12	0.12306	-9.09877	-9.96482	104	1.20863	0.82295	-0.04310
14	0.16465	-7.83435	-8.70040	106	1.20620	0.81420	-0.05185
16	0.21086	-6.76004	-7.62609	108	1.20294	0.80244	-0.06361
18	0.26101	-5.83335	-6.69940	110	1.19863	0.78686	-0.07919
20	0.31440	-5.02518	-5.89123	112	1.19304	0.76556	-0.09950
22	0.37028	-4.31467	-5.18072	114	1.18592	0.74056	-0.12549
24	0.42792	-3.68636	-4.55241	116	1.17702	0.70783	-0.15822
26	0.48659	-3.12839	-3.99444	118	1.16607	0.66726	-0.19879
28	0.54557	-2.63147	-3.49752	120	1.15284	0.61768	-0.24838
30	0.60421	-2.18815	-3.05420	122	1.13706	0.55783	-0.30822
32	0.66186	-1.79232	-2.65838	124	1.11852	0.48643	-0.37963
34	0.71797	-1.43891	-2.30496	126	1.09700	0.40207	-0.46399
36	0.77204	-1.12361	-1.98966	128	1.07233	0.30329	-0.56276
38	0.82362	-0.84273	-1.70878	130	1.04437	0.18855	-0.67750
40	0.87236	-0.59306	-1.45911	132	1.01302	0.05618	-0.80988
42	0.91796	-0.37178	-1.23783	134	0.97823	-0.09560	-0.96165
44	0.96021	-0.17635	-1.04240	136	0.94001	-0.26869	-1.13475
46	0.99896	-0.00450	-0.87055	138	0.89842	-0.46520	-1.33125
48	1.03415	0.14584	-0.72022	140	0.85361	-0.68740	-1.55345
50	1.06575	0.27656	-0.58949	142	0.80578	-0.93784	-1.80390
52	1.09381	0.38943	-0.47662	144	0.75520	-1.21937	-2.08542
54	1.11843	0.48610	-0.37995	146	0.70223	-1.53520	-2.40126
56	1.13975	0.56810	-0.29795	148	0.64728	-1.88905	-2.75511
58	1.15794	0.63687	-0.22918	150	0.59085	-2.28523	-3.15128
60	1.17322	0.69380	-0.17225	152	0.53348	-2.72882	-3.59487
62	1.18582	0.74019	-0.12586	154	0.47578	-3.22595	-4.09200
64	1.19598	0.77726	-0.08880	156	0.41840	-3.78407	-4.65012
66	1.20398	0.80618	-0.05987	158	0.36204	-4.41249	-5.27854
68	1.21006	0.82807	-0.03798	160	0.30739	-5.12307	-5.98912
70	1.21450	0.84396	-0.02209	162	0.25519	-5.93129	-6.79734
72	1.21754	0.85483	-0.01122	164	0.20616	-6.85800	-7.72405
74	1.21944	0.86160	-0.00446	166	0.16098	-7.93231	-8.79836
76	1.22042	0.86508	-0.00097	168	0.12032	-9.19673	-10.06278
78	1.22069	0.86505	0.0	170	0.08478	-10.71701	-11.58306
80	1.22044	0.86518	-0.00088	172	0.05491	-12.60319	-13.46924
82	1.21984	0.86304	-0.00301	174	0.03118	-15.06138	-15.92743
84	1.21903	0.86014	-0.00591	176	0.01395	-18.55415	-19.42020
86	1.21811	0.85686	-0.00919	178	0.00350	-24.55729	-25.42334
88	1.21717	0.85350	-0.01255	180	0.00000	-INFINITY	-INFINITY
90	1.21625	0.85025	-0.01581				

TABLE A1-23

INTEGRAL EQUATION METHOD
 EPSILDN= 2.2500(NORMALIZED GROUNDPLANE RADIUS)
 MONDPOLE LENGTH= 0.100000(WAVELENGTH)
 INFINITELY THIN MONDPOLE RADIUS
 RADIATION RESISTANCE = 2.851602 (DHMS)

ELEVATION ANGLE (DEG)	DIRECTIVITY (NUMERIC)	DIRECTIVITY (DBI)	RELATIVE POWER (DB)	ELEVATION ANGLE (DEG)	DIRECTIVITY (NUMERIC)	DIRECTIVITY (DBI)	RELATIVE POWER (DB)
0	0.00000	-INFINITY	-INFINITY	92.0	1.10911	0.44975	-0.29381
2.0	0.00443	-23.53888	-24.28243	94.0	1.10955	0.45149	-0.29207
4.0	0.01762	-17.53915	-18.28271	96.0	1.11118	0.45784	-0.28571
6.0	0.03934	-14.05206	-14.79562	98.0	1.11390	0.46844	-0.27511
8.0	0.06915	-11.60181	-12.34537	100.0	1.11757	0.48276	-0.26080
10.0	0.10652	-9.72583	-10.46939	102.0	1.12204	0.50009	-0.24345
12.0	0.15073	-8.21798	-8.96154	104.0	1.12710	0.51963	-0.22393
14.0	0.20099	-6.96821	-7.71177	106.0	1.13251	0.54041	-0.20315
16.0	0.25640	-5.91074	-6.65430	108.0	1.13798	0.56136	-0.18219
18.0	0.31601	-5.00304	-5.74660	110.0	1.14323	0.58133	-0.16223
20.0	0.37879	-4.21598	-4.95953	112.0	1.14790	0.59904	-0.14451
22.0	0.44375	-3.52866	-4.27222	114.0	1.15164	0.61319	-0.13037
24.0	0.50985	-2.92557	-3.66913	116.0	1.15408	0.62236	-0.12120
26.0	0.57613	-2.39482	-3.13838	118.0	1.15481	0.62510	-0.11846
28.0	0.64164	-1.92705	-2.67061	120.0	1.15343	0.61991	-0.12365
30.0	0.70554	-1.51475	-2.25831	122.0	1.14954	0.60523	-0.13832
32.0	0.76705	-1.15176	-1.89532	124.0	1.14274	0.57946	-0.16410
34.0	0.82548	-0.83291	-1.57647	126.0	1.13264	0.54093	-0.20263
36.0	0.88027	-0.55384	-1.29740	128.0	1.11890	0.48793	-0.25563
38.0	0.93095	-0.31076	-1.05431	130.0	1.10120	0.41866	-0.32490
40.0	0.97716	-0.10036	-0.84392	132.0	1.07926	0.33125	-0.41230
42.0	1.01866	0.08029	-0.66327	134.0	1.05287	0.22374	-0.51982
44.0	1.05532	0.23383	-0.50973	136.0	1.02189	0.09402	-0.64954
46.0	1.08709	0.36266	-0.38089	138.0	0.98624	-0.06015	-0.80371
48.0	1.11404	0.46901	-0.27454	140.0	0.94597	-0.24122	-0.98477
50.0	1.13630	0.55493	-0.18863	142.0	0.90119	-0.45184	-1.19540
52.0	1.15408	0.62235	-0.12120	144.0	0.85212	-0.69500	-1.43855
54.0	1.16765	0.67311	-0.07044	146.0	0.79910	-0.97401	-1.71757
56.0	1.17732	0.70896	-0.03460	148.0	0.74256	-1.29269	-2.03625
58.0	1.18347	0.73158	-0.01198	150.0	0.68306	-1.65544	-2.39899
60.0	1.18674	0.74258	0.00097	152.0	0.62124	-2.06742	-2.81098
62.0	1.18674	0.74356	0.0	154.0	0.55785	-2.53482	-3.27838
64.0	1.18458	0.73602	-0.00754	156.0	0.49372	-3.06519	-3.80874
66.0	1.18071	0.72145	-0.02211	158.0	0.42975	-3.66787	-4.41142
68.0	1.17525	0.70125	-0.04227	160.0	0.36688	-4.35477	-5.09833
70.0	1.16867	0.67692	-0.06664	162.0	0.30610	-5.14143	-5.88499
72.0	1.16136	0.64966	-0.09389	164.0	0.24839	-6.04874	-6.79230
74.0	1.15366	0.62079	-0.12276	166.0	0.19472	-7.10585	-7.84941
76.0	1.14591	0.59150	-0.15206	168.0	0.14604	-8.35529	-9.09885
78.0	1.13838	0.56288	-0.18067	170.0	0.10321	-9.86286	-10.60642
80.0	1.13134	0.53595	-0.20761	172.0	0.06701	-11.73860	-12.48216
82.0	1.12501	0.51158	-0.23198	174.0	0.03812	-14.18866	-14.93221
84.0	1.11958	0.49055	-0.25301	176.0	0.01708	-17.67561	-18.41916
86.0	1.11518	0.47346	-0.27010	178.0	0.00429	-23.67525	-24.41881
88.0	1.11193	0.46079	-0.28277	180	0.00000	-INFINITY	-INFINITY
90.0	1.10990	0.45284	-0.29077				

TABLE A1-24

INTEGRAL EQUATION METHOD
 EPSILON= 2.5000(NORMALIZED GROUNDPLANE RADIUS)
 MONDPOLE LENGTH= 0.100000(WAVELENGTH)
 INFINITELY THIN MONDPOLE RADIUS
 RADIATION RESISTANCE = 3.232568 (DHMS)

ELEVATION ANGLE (DEG)	DIRECTIVITY (NUMERIC)	DIRECTIVITY (DBI)	RELATIVE POWER (DB)	ELEVATION ANGLE (DEG)	DIRECTIVITY (NUMERIC)	DIRECTIVITY (DBI)	RELATIVE POWER (DB)
0	0.00000	-INFINITY	-INFINITY	92.0	0.97835	-0.09507	-0.97852
2.0	0.00561	-22.50875	-23.39219	94.0	0.98017	-0.08699	-0.97044
4.0	0.02232	-16.51271	-17.39616	96.0	0.98450	-0.06783	-0.95127
6.0	0.04975	-13.03178	-13.91522	98.0	0.99125	-0.03818	-0.92162
8.0	0.08729	-10.59013	-11.47357	100.0	1.00025	0.00110	-0.88234
10.0	0.13412	-8.72519	-9.60863	102.0	1.01132	0.04889	-0.83455
12.0	0.18920	-7.23080	-8.11424	104.0	1.02421	0.10389	-0.77956
14.0	0.25137	-5.99690	-6.88034	106.0	1.03863	0.16460	-0.71884
16.0	0.31932	-4.95768	-5.84113	108.0	1.05424	0.22939	-0.65405
18.0	0.39169	-4.07060	-4.95405	110.0	1.07066	0.29652	-0.58692
20.0	0.46704	-3.30649	-4.18993	112.0	1.08747	0.36417	-0.51928
22.0	0.54395	-2.64443	-3.52788	114.0	1.10419	0.43044	-0.45300
24.0	0.62103	-2.06888	-2.95232	116.0	1.12032	0.49342	-0.39002
26.0	0.69696	-1.56790	-2.45134	118.0	1.13532	0.55117	-0.33227
28.0	0.77053	-1.13210	-2.01554	120.0	1.14861	0.60174	-0.28170
30.0	0.84063	-0.75393	-1.63737	122.0	1.15962	0.64317	-0.24028
32.0	0.90632	-0.42717	-1.31061	124.0	1.16774	0.67348	-0.20996
34.0	0.96680	-0.14661	-1.03006	126.0	1.17238	0.69070	-0.19274
36.0	1.02145	0.09217	-0.79127	128.0	1.17296	0.69283	-0.19062
38.0	1.06980	0.29302	-0.59042	130.0	1.16891	0.67782	-0.20562
40.0	1.11156	0.45932	-0.42413	132.0	1.15974	0.64360	-0.23984
42.0	1.14659	0.59408	-0.28937	134.0	1.14499	0.58800	-0.29544
44.0	1.17491	0.70003	-0.18341	136.0	1.12429	0.50877	-0.37467
45.0	1.19665	0.77968	-0.10377	138.0	1.09737	0.40352	-0.47992
48.0	1.21209	0.83535	-0.04809	140.0	1.06407	0.26969	-0.61376
50.0	1.22159	0.86925	-0.01420	142.0	1.02435	0.10449	-0.77895
52.0	1.22559	0.88344	0.0	144.0	0.97834	-0.09512	-0.97857
54.0	1.22460	0.87996	-0.00349	146.0	0.92628	-0.33257	-1.21602
56.0	1.21920	0.86074	-0.02270	148.0	0.86861	-0.61173	-1.49518
58.0	1.20996	0.82771	-0.05573	150.0	0.80592	-0.93707	-1.82051
60.0	1.19750	0.78276	-0.10068	152.0	0.73896	-1.31381	-2.19726
62.0	1.18243	0.72776	-0.15568	154.0	0.66862	-1.74820	-2.63165
64.0	1.16536	0.66460	-0.21884	156.0	0.59596	-2.24781	-3.13126
66.0	1.14687	0.59515	-0.28830	158.0	0.52215	-2.82206	-3.70550
68.0	1.12753	0.52126	-0.36218	160.0	0.44845	-3.48287	-4.36631
70.0	1.10785	0.44481	-0.43863	162.0	0.37620	-4.24582	-5.12327
72.0	1.08834	0.36764	-0.51861	164.0	0.30677	-5.13184	-6.01529
74.0	1.06944	0.29156	-0.59188	166.0	0.24154	-6.17010	-7.05354
76.0	1.05155	0.21832	-0.66513	168.0	0.18184	-7.40316	-8.28660
78.0	1.03505	0.14959	-0.73385	170.0	0.12892	-8.89682	-9.78026
80.0	1.02022	0.08695	-0.79649	172.0	0.08392	-10.76117	-11.64461
82.0	1.00736	0.03183	-0.85161	174.0	0.04784	-13.20234	-14.08579
84.0	0.99666	-0.01453	-0.89797	176.0	0.02146	-16.68294	-17.56638
86.0	0.98811	-0.05107	-0.93451	178.0	0.00540	-22.67877	-23.56222
88.0	0.98213	-0.07699	-0.96044	180.0	0.00000	-INFINITY	-INFINITY
90.0	0.97910	-0.09175	-0.97514				

TABLE A1-25

INTEGRAL EQUATION METHOD
 EPSILON= 2.7500(NORMALIZED GROUNDOPLANE RADIUS)
 MONOPOLE LENGTH= 0.100000(WAVELENGTH)
 INFINITELY THIN MONOPOLE RADIUS
 RADIATION RESISTANCE = 3.832907 (OHMS)

ELEVATION ANGLE (DEG)	DIRECTIVITY (NUMERIC)	DIRECTIVITY (DBI)	RELATIVE POWER (DB)	ELEVATION ANGLE (DEG)	DIRECTIVITY (NUMERIC)	DIRECTIVITY (DBI)	RELATIVE POWER (DB)
0	0.00000	-INFINITY	-INFINITY	92.0	0.82283	-0.84689	-2.10422
2.0	0.33458	-4.75496	-6.01229	94.0	0.82389	-0.84132	-2.09866
4.0	0.08184	-10.87035	-12.01268	96.0	0.82886	-0.81521	-2.07254
6.0	0.03555	-14.49103	-15.74836	98.0	0.83765	-0.76940	-2.02673
8.0	0.01953	-17.09339	-18.35072	100.0	0.85011	-0.70525	-1.96258
10.0	0.01219	-19.14066	-20.39799	102.0	0.86606	-0.62453	-1.88186
12.0	0.00824	-20.83972	-22.09705	104.0	0.88524	-0.52937	-1.78671
14.0	0.00589	-22.30144	-23.55878	106.0	0.90737	-0.42217	-1.67950
16.0	0.00437	-23.59260	-24.84993	108.0	0.93207	-0.30550	-1.56283
18.0	0.00334	-24.75685	-26.01418	110.0	0.95895	-0.18206	-1.43939
20.0	0.00262	-25.82470	-27.08203	112.0	0.98751	-0.05460	-1.31193
22.0	0.00208	-26.81867	-28.07601	114.0	1.01722	0.07415	-1.18318
24.0	0.00168	-27.75632	-29.01366	116.0	1.04749	0.20148	-1.05585
26.0	0.00136	-28.65205	-29.90938	118.0	1.07764	0.32475	-0.93259
28.0	0.00112	-29.51836	-30.77569	120.0	1.10698	0.44139	-0.81595
30.0	0.00092	-30.36685	-31.62418	122.0	1.13473	0.54891	-0.70842
32.0	0.00076	-31.20899	-32.46633	124.0	1.16009	0.64491	-0.61242
34.0	0.00062	-32.05707	-33.31441	126.0	1.18223	0.72702	-0.53031
36.0	0.00051	-32.92525	-34.18258	128.0	1.20031	0.79293	-0.46440
38.0	0.00041	-33.83118	-35.08851	130.0	1.21348	0.84034	-0.41699
40.0	0.00033	-34.79874	-36.05607	132.0	1.22094	0.86696	-0.39038
42.0	0.00026	-35.86305	-37.12038	134.0	1.22192	0.87044	-0.36689
44.0	0.00020	-37.08103	-38.33836	136.0	1.21574	0.84839	-0.40894
46.0	0.00014	-38.55739	-39.81472	138.0	1.20180	0.79830	-0.45903
48.0	0.00009	-40.52488	-41.78221	140.0	1.17965	0.71752	-0.53982
50.0	0.00004	-43.72276	-44.98009	142.0	1.14899	0.60317	-0.65417
52.0	1.33577	1.25733	0.0	144.0	1.10972	0.45212	-0.80521
54.0	1.31585	1.19205	-0.06528	146.0	1.06192	0.26091	-0.99642
56.0	1.29097	1.10916	-0.14817	148.0	1.00591	0.02560	-1.23173
58.0	1.26203	1.01071	-0.24662	150.0	0.94225	-0.25832	-1.51565
60.0	1.22992	0.89877	-0.35856	152.0	0.87174	-0.59613	-1.85346
62.0	1.19549	0.77545	-0.48189	154.0	0.79541	-0.99409	-2.25142
64.0	1.15955	0.64289	-0.61444	156.0	0.71452	-1.45984	-2.71717
66.0	1.12288	0.50334	-0.75399	158.0	0.63055	-2.00280	-3.26013
68.0	1.08620	0.35911	-0.89822	160.0	0.54514	-2.63494	-3.89227
70.0	1.05017	0.21259	-1.04474	162.0	0.46006	-3.37187	-4.62921
72.0	1.01537	0.06626	-1.19108	164.0	0.37718	-4.23454	-5.49187
74.0	0.98235	-0.07734	-1.33468	166.0	0.29839	-5.25213	-6.50947
76.0	0.95156	-0.21562	-1.47295	168.0	0.22557	-6.46724	-7.72457
78.0	0.92342	-0.34599	-1.60332	170.0	0.16048	-7.94569	-9.20302
80.0	0.89828	-0.46590	-1.72323	172.0	0.10477	-9.79756	-11.05489
82.0	0.87641	-0.57291	-1.83025	174.0	0.05985	-12.22902	-13.48635
84.0	0.85807	-0.66479	-1.92212	176.0	0.02690	-15.70267	-16.96000
86.0	0.84342	-0.73954	-2.00687	178.0	0.00677	-21.69433	-22.95166
88.0	0.83262	-0.79553	-2.05286	180	0.00000	-INFINITY	-INFINITY
90.0	0.82574	-0.83155	-2.08889				

TABLE A1-26

INTEGRAL EQUATION METHOD
 EPSILON= 0.0 (NORMALIZED GROUNDPLANE RADIUS)
 MONDPOLE LENGTH= 0.025000(WAVELENGTH)
 INFINITELY THIN MONDPOLE RADIUS
 RADIATION RESISTANCE = 0.123760 (OHMS)

ELEVATION ANGLE (DEG)	DIRECTIVITY (NUMERIC)	DIRECTIVITY (DBI)	RELATIVE POWER (DB)	ELEVATION ANGLE (DEG)	DIRECTIVITY (NUMERIC)	DIRECTIVITY (DBI)	RELATIVE POWER (DB)
0	0.00000	-INFINITY	-INFINITY	92.0	1.49858	1.75680	-0.00530
2.0	0.00182	-27.38746	-29.14957	94.0	1.49310	1.74089	-0.02121
4.0	0.00729	-21.37213	-23.13424	96.0	1.48400	1.71433	-0.04778
6.0	0.01637	-17.85910	-19.62120	98.0	1.47131	1.67704	-0.08506
8.0	0.02902	-15.37263	-17.13473	100.0	1.45511	1.62895	-0.13315
10.0	0.04518	-13.45027	-15.21237	102.0	1.43547	1.56993	-0.19217
12.0	0.06477	-11.88602	-13.64812	104.0	1.41248	1.49984	-0.26227
14.0	0.08770	-10.57000	-12.33210	106.0	1.38627	1.41848	-0.34362
16.0	0.11385	-9.43664	-11.19874	108.0	1.35696	1.32566	-0.43644
18.0	0.14310	-8.44364	-10.20574	110.0	1.32468	1.22112	-0.54098
20.0	0.17530	-7.56212	-9.32423	112.0	1.28961	1.10458	-0.65752
22.0	0.21030	-6.77151	-8.53361	114.0	1.25191	0.97572	-0.78638
24.0	0.24794	-6.05660	-7.81870	116.0	1.21176	0.83416	-0.92794
26.0	0.28801	-5.40587	-7.16797	118.0	1.16936	0.67949	-1.08261
28.0	0.33034	-4.81035	-6.57246	120.0	1.12492	0.51123	-1.25088
30.0	0.37472	-4.26296	-6.02507	122.0	1.07866	0.32884	-1.43326
32.0	0.42092	-3.75799	-5.52009	124.0	1.03080	0.13173	-1.63038
34.0	0.46873	-3.29076	-5.05286	126.0	0.98157	-0.08080	-1.84290
36.0	0.51791	-2.85742	-4.61952	128.0	0.93121	-0.30951	-2.07161
38.0	0.56823	-2.45476	-4.21686	130.0	0.87998	-0.55528	-2.31738
40.0	0.61944	-2.08004	-3.84215	132.0	0.82811	-0.81909	-2.58120
42.0	0.67128	-1.73097	-3.49307	134.0	0.77587	-1.10209	-2.86419
44.0	0.72351	-1.40555	-3.16766	136.0	0.72351	-1.40555	-3.16766
46.0	0.77587	-1.10209	-2.86419	138.0	0.67128	-1.73097	-3.49307
48.0	0.82811	-0.81909	-2.58120	140.0	0.61944	-2.08004	-3.84215
50.0	0.87998	-0.55528	-2.31738	142.0	0.56823	-2.45476	-4.21686
52.0	0.93121	-0.30951	-2.07161	144.0	0.51791	-2.85742	-4.61952
54.0	0.98157	-0.08080	-1.84290	146.0	0.46873	-3.29076	-5.05286
56.0	1.03080	0.13173	-1.63038	148.0	0.42092	-3.75799	-5.52009
58.0	1.07866	0.32884	-1.43326	150.0	0.37472	-4.26296	-6.02507
60.0	1.12492	0.51123	-1.25088	152.0	0.33034	-4.81035	-6.57246
62.0	1.16936	0.67949	-1.08261	154.0	0.28801	-5.40587	-7.16797
64.0	1.21176	0.83416	-0.92794	156.0	0.24794	-6.05660	-7.81870
66.0	1.25191	0.97572	-0.78638	158.0	0.21030	-7.7151	-8.53361
68.0	1.28961	1.10458	-0.65752	160.0	0.17530	-9.32423	-9.32423
70.0	1.32468	1.22112	-0.54098	162.0	0.14310	-10.20574	-10.20574
72.0	1.35696	1.32566	-0.43664	164.0	0.11385	-11.19874	-11.19874
74.0	1.38627	1.41848	-0.34362	166.0	0.08770	-12.33210	-12.33210
76.0	1.41248	1.49984	-0.26227	168.0	0.06477	-13.64812	-13.64812
78.0	1.43547	1.56993	-0.19217	170.0	0.04518	-15.21237	-15.21237
80.0	1.45511	1.62895	-0.13315	172.0	0.02902	-17.13473	-17.13473
82.0	1.47131	1.67704	-0.08506	174.0	0.01637	-19.62120	-19.62120
84.0	1.48400	1.71433	-0.04778	176.0	0.00729	-23.13424	-23.13424
86.0	1.49310	1.74089	-0.02121	178.0	0.00182	-29.14957	-29.14957
88.0	1.49858	1.75680	-0.00530	180	0.00000	-INFINITY	-INFINITY
90.0	1.50041	1.76210	0.0				

TABLE A1-27

INTEGRAL EQUATION METHOD
 $\epsilon/\pi L = 0.2500$ (NORMALIZED GROUNDPLANE RADIUS)
 MONOPOLE LENGTH = $0.025000(\lambda)$ (WAVELENGTH)
 INFINITELY THIN MONOPOLE RADIUS
 RADIATION RESISTANCE = 0.124029 (OHMS)

ELEVATION ANGLE (DEG)	DIRECTIVITY (NUMERIC)	DIRECTIVITY (DB)	RELATIVE POWER (DB)	ELEVATION ANGLE (DEG)	DIRECTIVITY (NUMERIC)	DIRECTIVITY (DB)	RELATIVE POWER (DB)
0	0.00000	-INFINITY	-INFINITY	92	1.49534	1.74741	-0.00524
2	0.00184	-27.34979	-29.10244	94	1.48993	1.73167	-0.02098
4	0.00735	-21.33463	-23.08729	96	1.48095	1.70539	-0.04726
6	0.01651	-17.82188	-19.57453	98	1.46842	1.66851	-0.08415
8	0.02927	-15.33581	-17.08847	100	1.45242	1.62093	-0.13173
10	0.04556	-13.41396	-15.16661	102	1.43302	1.56252	-0.19013
12	0.06531	-11.85032	-13.60298	104	1.41031	1.49315	-0.25950
14	0.08841	-10.53503	-12.28768	106	1.38440	1.41262	-0.34003
16	0.11475	-9.40249	-11.15514	108	1.35541	1.32072	-0.43193
18	0.14420	-8.41041	-10.16306	110	1.32349	1.21720	-0.53546
20	0.17661	-7.52991	-9.28256	112	1.28877	1.10176	-0.65089
22	0.21182	-6.74039	-8.49305	114	1.25143	0.97408	-0.77857
24	0.24965	-6.02667	-7.77932	116	1.21165	0.83379	-0.91887
26	0.28992	-5.37720	-7.12985	118	1.16962	0.68045	-1.07221
28	0.33243	-4.78301	-6.53567	120	1.12553	0.51358	-1.23907
30	0.37696	-4.23702	-5.98967	122	1.07961	0.33265	-1.42000
32	0.42330	-3.73349	-5.48615	124	1.03206	0.13704	-1.61561
34	0.47122	-3.26777	-5.02042	126	0.98312	-0.07394	-1.82659
36	0.52048	-2.83598	-4.58863	128	0.93303	-0.30107	-2.05372
38	0.57083	-2.43490	-4.18755	130	0.88202	-0.54522	-2.29788
40	0.62204	-2.06179	-3.81445	132	0.83035	-0.80741	-2.56006
42	0.67385	-1.71435	-3.46700	134	0.77826	-1.08876	-2.84141
44	0.72601	-1.39058	-3.14323	136	0.72601	-1.39058	-3.14323
46	0.7826	-1.08876	-2.84141	138	0.67385	-1.71435	-3.46700
48	0.83035	-0.80741	-2.56006	140	0.62204	-2.06179	-3.81445
50	0.88202	-0.54522	-2.29787	142	0.57083	-2.43490	-4.18755
52	0.93303	-0.30107	-2.05372	144	0.52048	-2.83598	-4.58863
54	0.98312	-0.07394	-1.82659	146	0.47122	-3.26777	-5.02042
56	1.03206	0.13704	-1.61561	148	0.42330	-3.73350	-5.48615
58	1.07961	0.33265	-1.42000	150	0.37696	-4.23702	-5.98967
60	1.12553	0.51358	-1.23907	152	0.33243	-4.78302	-6.53567
62	1.16962	0.68045	-1.07221	154	0.28992	-5.37720	-7.12985
64	1.21165	0.83379	-0.91887	156	0.24965	-6.02667	-7.77932
66	1.25144	0.97408	-0.77857	158	0.21182	-6.74039	-8.49305
68	1.28877	1.10176	-0.65089	160	0.17661	-7.52991	-9.28256
70	1.32349	1.21720	-0.53546	162	0.14420	-8.41041	-10.16306
72	1.35541	1.32072	-0.43193	164	0.11475	-9.40249	-11.15514
74	1.38440	1.41262	-0.34003	166	0.08841	-10.53503	-12.28768
76	1.41031	1.49315	-0.25950	168	0.06531	-11.85033	-13.60298
78	1.43302	1.56252	-0.19013	170	0.04556	-13.41396	-15.16661
80	1.45242	1.62093	-0.13173	172	0.02927	-15.33582	-17.08847
82	1.46842	1.66851	-0.08414	174	0.01651	-17.82188	-19.57454
84	1.48095	1.70539	-0.04726	176	0.00735	-21.33463	-23.08729
86	1.48993	1.73167	-0.02098	178	0.00184	-27.34979	-29.10244
88	1.49534	1.74741	-0.00524	180	0.00000	-INFINITY	-INFINITY
90	1.49715	1.75265	0				

TABLE A1-28

INTEGRAL EQUATION METHOD
 EPSILON= 0.500(NORMALIZED GROUNDPLANE RADIUS)
 MONDPOLE LENGTH= 0.025000(WAVELENGTH)
 INFINITELY THIN MONDPOLE RADIUS
 RADIATION RESISTANCE = 0.124796 (DHMS)

ELEVATION ANGLE (DEG)	DIRECTIVITY (NUMERIC)	DIRECTIVITY (DBI)	RELATIVE POWER (DB)	ELEVATION ANGLE (DEG)	DIRECTIVITY (NUMERIC)	DIRECTIVITY (DBI)	RELATIVE POWER (DB)
0	0.00000	-INFINITY	-INFINITY	92	1.48621	1.72081	-0.00508
2	0.00189	-27.24403	-28.96992	94	1.48100	1.70555	-0.02034
4	0.00753	-21.22935	-22.95524	96	1.47234	1.68008	-0.04581
6	0.01691	-17.71740	-19.44329	98	1.46027	1.64432	-0.08157
8	0.02997	-15.23245	-16.95834	100	1.44483	1.59818	-0.12771
10	0.04664	-13.31202	-15.03791	102	1.42611	1.54152	-0.18437
12	0.06683	-11.75011	-13.47600	104	1.40417	1.47418	-0.25171
14	0.09043	-10.43683	-12.16272	106	1.37911	1.39598	-0.32991
16	0.11731	-9.30660	-11.03249	108	1.35104	1.30668	-0.41921
18	0.14733	-8.31709	-10.04298	110	1.32008	1.20602	-0.51987
20	0.18033	-7.43943	-9.16532	112	1.28638	1.09369	-0.63220
22	0.21612	-6.65301	-8.37890	114	1.25007	0.96935	-0.75654
24	0.25453	-5.94260	-7.66849	116	1.21133	0.83261	-0.89328
26	0.29535	-5.29666	-7.02255	118	1.17032	0.68303	-1.04286
28	0.33836	-4.70621	-6.43210	120	1.12722	0.52010	-1.20579
30	0.38334	-4.16414	-5.89003	122	1.08225	0.34327	-1.38262
32	0.43006	-3.66469	-5.39058	124	1.03559	0.15189	-1.57400
34	0.47828	-3.20318	-4.92907	126	0.98748	-0.05473	-1.78062
36	0.52775	-2.77574	-4.50163	128	0.93812	-0.27740	-2.00329
38	0.57822	-2.37910	-4.10499	130	0.88776	-0.51702	-2.24291
40	0.62943	-2.01052	-3.73641	132	0.83664	-0.77462	-2.50051
42	0.68114	-1.66766	-3.39355	134	0.78499	-1.05135	-2.77774
44	0.73308	-1.34850	-3.07439	136	0.73307	-1.34854	-3.07443
46	0.78500	-1.05132	-2.77721	138	0.68113	-1.66770	-3.39359
48	0.83665	-0.77458	-2.50048	140	0.62942	-2.01056	-3.73645
50	0.88777	-0.51699	-2.24288	142	0.57821	-2.37914	-4.10503
52	0.93813	-0.27737	-2.00326	144	0.52774	-2.77578	-4.50167
54	0.98748	-0.05470	-1.78059	146	0.47827	-3.20323	-4.92912
56	1.03560	0.15192	-1.57397	148	0.43006	-3.66473	-5.39062
58	1.08225	0.34329	-1.38260	150	0.38334	-4.16418	-5.89007
60	1.12723	0.52013	-1.20576	152	0.33836	-4.70626	-6.43215
62	1.17032	0.68305	-1.04284	154	0.29534	-5.29671	-7.02260
64	1.21133	0.83264	-0.89325	156	0.25453	-5.94265	-7.66854
66	1.25008	0.96937	-0.75652	158	0.21612	-6.65305	-8.37894
68	1.28638	1.09371	-0.63218	160	0.18032	-7.43948	-9.16537
70	1.32009	1.20603	-0.51986	162	0.14733	-8.31714	-10.04303
72	1.35104	1.30669	-0.41920	164	0.11731	-9.30665	-11.03254
74	1.37911	1.39599	-0.32990	166	0.09043	-10.43688	-12.16277
76	1.40417	1.47420	-0.25169	168	0.06683	-11.75016	-13.47605
78	1.42611	1.54153	-0.18436	170	0.04664	-13.31207	-15.03796
80	1.44484	1.59819	-0.12770	172	0.02997	-15.23250	-16.95839
82	1.46027	1.64433	-0.08156	174	0.01691	-17.71745	-19.44334
84	1.47234	1.68009	-0.04580	176	0.00753	-21.22940	-22.95529
86	1.48100	1.70556	-0.02033	178	0.00189	-27.24408	-28.96997
88	1.48621	1.72081	-0.00508	180	0.00000	-INFINITY	-INFINITY
90	1.48795	1.72589	0				

TABLE A1-29

INTEGRAL EQUATION METHOD
 EPSILON= 0.7500(NORMALIZED GROUNDPLANE RADIUS)
 MONOPOLE LENGTH= 0.025000(WAVELENGTH)
 INFINITELY THIN MONOPOLE RADIUS
 RADIATION RESISTANCE = 0.126059 (OHMS)

ELEVATION ANGLE (DEG)	DIRECTIVITY (NUMERIC)	DIRECTIVITY (DBI)	RELATIVE POWER (DB)	ELEVATION ANGLE (DEG)	DIRECTIVITY (NUMERIC)	DIRECTIVITY (DBI)	RELATIVE POWER (DB)
0	0.00000	-INFINITY	-INFINITY	92.0	1.47141	1.67733	-0.00482
2.0	0.00196	-27.07383	-28.75599	94.0	1.46651	1.66286	-0.01929
4.0	0.00783	-21.05993	-22.74208	96.0	1.45838	1.63869	-0.04346
6.0	0.01758	-17.54926	-19.23141	98.0	1.44702	1.60476	-0.07740
8.0	0.03115	-15.06609	-16.74825	100.0	1.43250	1.56094	-0.12121
10.0	0.04844	-13.14795	-14.83010	102.0	1.41485	1.50711	-0.17505
12.0	0.06936	-11.58881	-13.27096	104.0	1.39414	1.44307	-0.23908
14.0	0.09378	-10.27877	-11.96093	106.0	1.37045	1.36864	-0.31352
16.0	0.12156	-9.15224	-10.83439	108.0	1.34386	1.28355	-0.39861
18.0	0.15252	-8.16687	-9.84903	110.0	1.31447	1.18752	-0.49463
20.0	0.18648	-7.29377	-8.97592	112.0	1.28240	1.08023	-0.60192
22.0	0.22324	-6.51230	-8.19445	114.0	1.24776	0.96130	-0.72085
24.0	0.26259	-5.80722	-7.48938	116.0	1.21069	0.83033	-0.85183
26.0	0.30430	-5.16697	-6.84912	118.0	1.17134	0.68682	-0.99533
28.0	0.34814	-4.58252	-6.26468	120.0	1.12986	0.53026	-1.15189
30.0	0.39385	-4.04674	-5.72889	122.0	1.08644	0.36005	-1.32210
32.0	0.44118	-3.55386	-5.23601	124.0	1.04125	0.17553	-1.50662
34.0	0.48988	-3.09915	-4.78130	126.0	0.99448	-0.02405	-1.70620
36.0	0.53967	-2.67869	-4.36085	128.0	0.94634	-0.23952	-1.92167
38.0	0.59031	-2.28921	-3.97137	130.0	0.89705	-0.47182	-2.15398
40.0	0.64152	-1.92793	-3.61008	132.0	0.84683	-0.72202	-2.40417
42.0	0.69303	-1.59245	-3.27461	134.0	0.79592	-0.99130	-2.67345
44.0	0.74460	-1.28075	-2.96290	136.0	0.74456	-1.28102	-2.96317
46.0	0.79597	-0.99103	-2.67318	138.0	0.69299	-1.59274	-3.27489
48.0	0.84688	-0.72176	-2.40391	140.0	0.64147	-1.92822	-3.61037
50.0	0.89710	-0.47158	-2.15373	142.0	0.59027	-2.28951	-3.97167
52.0	0.94639	-0.23928	-1.92144	144.0	0.53963	-2.67900	-4.36115
54.0	0.99453	-0.02382	-1.70597	146.0	0.48984	-3.09946	-4.78161
56.0	1.04130	0.17575	-1.50641	148.0	0.44115	-3.55418	-5.23633
58.0	1.08649	0.36026	-1.32190	150.0	0.39382	-4.04707	-5.72922
60.0	1.12991	0.53046	-1.15170	152.0	0.34811	-4.58286	-6.26501
62.0	1.17139	0.68700	-0.99515	154.0	0.30428	-5.16731	-6.84946
64.0	1.21074	0.83050	-0.85166	156.0	0.26257	-5.80757	-7.48972
66.0	1.24780	0.96146	-0.72069	158.0	0.22322	-6.51265	-8.19480
68.0	1.28244	1.08038	-0.60178	160.0	0.18646	-7.29412	-8.97627
70.0	1.31451	1.18765	-0.49450	162.0	0.15250	-8.16723	-9.84938
72.0	1.34390	1.28367	-0.39849	164.0	0.12155	-9.15260	-10.83475
74.0	1.37049	1.36874	-0.31341	166.0	0.09377	-10.27914	-11.96129
76.0	1.39417	1.44317	-0.23899	168.0	0.06936	-11.58917	-13.27133
78.0	1.41488	1.50719	-0.17497	170.0	0.04844	-13.14832	-14.83047
80.0	1.43252	1.56101	-0.12114	172.0	0.03114	-15.06646	-16.74862
82.0	1.44704	1.60481	-0.07734	174.0	0.01758	-17.54963	-19.23179
84.0	1.45839	1.63874	-0.04342	176.0	0.00783	-21.06030	-22.74246
86.0	1.46552	1.66289	-0.01927	178.0	0.00196	-28.75536	-28.75536
88.0	1.47141	1.67734	-0.00481	180.0	0.00000	-INFINITY	-INFINITY
90.0	1.47304	1.68215	0.0				

TABLE A1-30

INTEGRAL EQUATION METHOD
 EPSILON= 1.0000(NORMALIZED GROUNDPLANE RADIUS)
 MONOPOLE LENGTH= 0.025000(WAVELENGTH)
 INFINITELY THIN MONOPOLE RADIUS
 RADIATION RESISTANCE = 0.127888 (OHMS)

ELEVATION ANGLE (DEG)	OIRECTIVITY (NUMERIC)	OIRECTIVITY (DBI)	RELATIVE POWER (DB)	ELEVATION ANGLE (DEG)	OIRECTIVITY (NUMERIC)	OIRECTIVITY (DBI)	RELATIVE POWER (DB)
0	0.00000	-INFINITY	-INFINITY	92	1.45048	1.61512	-0.00447
2	0.00207	-26.83564	-28.45522	94	1.44602	1.60174	-0.01784
4	0.00827	-20.82281	-22.44239	96	1.43860	1.57941	-0.04017
6	0.01856	-17.31393	-18.93351	98	1.42825	1.54805	-0.07154
8	0.03286	-14.83325	-16.45284	100	1.41498	1.50751	-0.11207
10	0.05107	-12.91829	-14.53787	102	1.39883	1.45766	-0.16192
12	0.07306	-11.36301	-12.98259	104	1.37984	1.39829	-0.22129
14	0.09868	-10.05749	-11.67708	106	1.35805	1.32917	-0.29041
16	0.12776	-8.93611	-10.55570	108	1.33353	1.25003	-0.36956
18	0.16008	-7.95652	-9.57611	110	1.30634	1.16055	-0.45904
20	0.19544	-7.08978	-8.70936	112	1.27655	1.06036	-0.55922
22	0.23360	-6.31523	-7.93481	114	1.24425	0.94907	-0.67051
24	0.27431	-5.61760	-7.23718	116	1.20954	0.82622	-0.79337
26	0.31730	-4.98528	-6.60487	118	1.17254	0.69128	-0.92830
28	0.36231	-4.40823	-6.02881	120	1.13336	0.54370	-1.07589
30	0.40905	-3.88225	-5.50184	122	1.09215	0.38282	-1.23677
32	0.45724	-3.39855	-5.01814	124	1.04905	0.20794	-1.41164
34	0.50660	-2.95335	-4.57294	126	1.00422	0.01827	-1.60131
36	0.55684	-2.54270	-4.16228	128	0.95784	-0.18708	-1.80666
38	0.60768	-2.16325	-3.78284	130	0.91010	-0.40909	-2.02868
40	0.65884	-1.81219	-3.43178	132	0.86121	-0.64888	-2.26847
42	0.71005	-1.48709	-3.10667	134	0.81139	-0.90770	-2.52729
44	0.76105	-1.18584	-2.80543	136	0.76086	-1.18695	-2.80654
46	0.81159	-0.90663	-2.52621	138	0.70987	-1.48823	-3.10782
48	0.86142	-0.64785	-2.26743	140	0.65866	-1.81337	-3.43295
50	0.91031	-0.40809	-2.02768	142	0.60751	-2.16446	-3.78405
52	0.95805	-0.18611	-1.80570	144	0.55668	-2.54393	-4.16352
54	1.00443	0.01919	-1.60039	146	0.50645	-2.95461	-4.57420
56	1.04926	0.20882	-1.41076	148	0.45711	-3.39984	-5.01942
58	1.09236	0.38366	-1.23593	150	0.40892	-3.88356	-5.50315
60	1.13357	0.54449	-1.07510	152	0.36220	-4.41056	-6.03015
62	1.17274	0.69203	-0.92756	154	0.31720	-4.98663	-6.60622
64	1.20974	0.82691	-0.79267	156	0.27422	-5.61897	-7.23856
66	1.24443	0.94972	-0.66987	158	0.23353	-6.31661	-7.93620
68	1.27672	1.06096	-0.55862	160	0.19538	-7.09118	-8.71077
70	1.30650	1.16109	-0.45849	162	0.16003	-7.95794	-9.57752
72	1.33368	1.25052	-0.36906	164	0.12772	-8.93754	-10.55713
74	1.35819	1.32962	-0.28997	166	0.09865	-10.05893	-11.67852
76	1.37997	1.39868	-0.22090	168	0.07304	-11.36446	-12.98404
78	1.39894	1.45800	-0.16159	170	0.05105	-12.91975	-14.53933
80	1.41507	1.50779	-0.11179	172	0.03285	-14.83472	-16.45430
82	1.42832	1.54827	-0.07132	174	0.01855	-17.31540	-18.93498
84	1.43866	1.57958	-0.04000	176	0.00827	-20.82428	-22.44387
86	1.44606	1.60185	-0.01773	178	0.00207	-26.83711	-28.45670
88	1.45050	1.61517	-0.00441	180	0.00000	-INFINITY	-INFINITY
90	1.45197	1.61959	0				

TABLE A1-31

INTEGRAL EQUATION METHOD
 EPSILON= 1.2500(NORMALIZED GROUNDPLANE RADIUS)
 MONOPOLE LENGTH= 0.025000(WAVELENGTH)
 INFINITELY THIN MONOPOLE RADIUS
 RADIATION RESISTANCE = 0.130457 (OHMS)

ELEVATION ANGLE θ (DEG)	DIRECTIVITY (NUMERIC)	DIRECTIVITY (DB)	RELATIVE POWER (DB)	ELEVATION ANGLE (DEG)	DIRECTIVITY (NUMERIC)	DIRECTIVITY (DB)	RELATIVE POWER (DB)
0	0.0000	-INFINITY	-INFINITY	92.0	1.42207	1.52920	-0.00402
2.0	0.00223	-26.51682	-28.05005	94.0	1.41818	1.51730	-0.01592
4.0	0.00890	-20.50543	-22.03865	96.0	1.41171	1.49745	-0.03577
6.0	0.01996	-16.99892	-18.53214	98.0	1.40267	1.46955	-0.06367
8.0	0.03531	-14.52156	-16.05478	100.0	1.39106	1.43347	-0.09975
10.0	0.05482	-12.61082	-14.14404	102.0	1.37690	1.38901	-0.14421
12.0	0.07833	-11.06068	-12.59390	104.0	1.36018	1.33597	-0.19726
14.0	0.10565	-9.76118	-11.29440	106.0	1.34093	1.27406	-0.25917
16.0	0.13656	-8.64667	-10.17989	108.0	1.31916	1.20297	-0.33025
18.0	0.17081	-7.67476	-9.20798	110.0	1.29490	1.12236	-0.41086
20.0	0.20814	-6.81649	-8.34971	112.0	1.26818	1.03180	-0.50142
22.0	0.24825	-6.05117	-7.58439	114.0	1.23904	0.93085	-0.60237
24.0	0.29084	-5.36347	-6.89670	116.0	1.20753	0.81899	-0.71423
26.0	0.33560	-4.74175	-6.27497	118.0	1.17372	0.69564	-0.83758
28.0	0.38222	-4.17691	-5.71013	120.0	1.13768	0.56019	-0.97303
30.0	0.43036	-3.66171	-5.19493	122.0	1.09949	0.41192	-1.12130
32.0	0.47970	-3.19029	-4.72351	124.0	1.05927	0.25007	-1.28315
34.0	0.52993	-2.75783	-4.29105	126.0	1.01713	0.07376	-1.45946
36.0	0.58072	-2.36030	-3.89352	128.0	0.97321	-0.11794	-1.65116
38.0	0.63178	-1.99432	-3.52754	130.0	0.92766	-0.32610	-1.85932
40.0	0.68281	-1.65698	-3.19020	132.0	0.88066	-0.55190	-2.08512
42.0	0.73353	-1.34580	-2.87902	134.0	0.83241	-0.79664	-2.32986
44.0	0.78368	-1.05862	-2.59184	136.0	0.78310	-1.06182	-2.59504
46.0	0.83300	-0.79354	-2.32676	138.0	0.73298	-1.34909	-2.88231
48.0	0.88127	-0.54889	-2.08211	140.0	0.68228	-1.66035	-3.19357
50.0	0.92828	-0.32320	-1.85642	142.0	0.63128	-1.99777	-3.53099
52.0	0.97383	-0.11515	-1.64837	144.0	0.58025	-2.36383	-3.89705
54.0	1.01776	0.07644	-1.45678	146.0	0.52949	-2.76143	-4.29465
56.0	1.05989	0.25263	-1.28060	148.0	0.47930	-3.19395	-4.72718
58.0	1.10011	0.41436	-1.11886	150.0	0.42999	-3.66544	-5.19866
60.0	1.13828	0.56250	-0.97072	152.0	0.38188	-4.18069	-5.71391
62.0	1.17431	0.69782	-0.83540	154.0	0.33531	-4.74559	-6.27881
64.0	1.20810	0.82103	-0.71219	156.0	0.29058	-5.36736	-6.90058
66.0	1.23958	0.93275	-0.60047	158.0	0.24802	-6.05510	-7.58832
68.0	1.26869	1.03356	-0.49966	160.0	0.20795	-6.82046	-8.35368
70.0	1.29538	1.12397	-0.40925	162.0	0.17066	-7.67877	-9.21199
72.0	1.31960	1.20443	-0.32879	164.0	0.13614	-8.65070	-10.18392
74.0	1.34133	1.27536	-0.25786	166.0	0.10555	-9.76524	-11.29846
76.0	1.36054	1.33711	-0.19611	168.0	0.07826	-11.06477	-12.59799
78.0	1.37721	1.39000	-0.14322	170.0	0.05477	-12.61493	-14.14815
80.0	1.39133	1.43430	-0.09893	172.0	0.03527	-14.52568	-16.05890
82.0	1.40288	1.47022	-0.06300	174.0	0.01994	-17.00306	-18.53628
84.0	1.41187	1.49795	-0.04527	176.0	0.00889	-20.50957	-22.04279
86.0	1.41828	1.51763	-0.03159	178.0	0.00223	-26.52098	-28.05420
88.0	1.42212	1.52937	-0.00385	180	0.00000	-INFINITY	-INFINITY
90.0	1.42338	1.53322	0.0				

TABLE A1-32

INTEGRAL EQUATION METHOD
 EPSILON= 1.5000(NORMALIZED GROUNDPLANE RADIUS)
 MONOPOLE LENGTH= 0.025000(WAVELENGTH)
 INFINITELY THIN MONOPOLE RADIUS
 RADIATION RESISTANCE = 0.134091 (OHMS)

ELEVATION ANGLE (DEG)	DIRECTIVITY (NUMERIC)	DIRECTIVITY (DBI)	RELATIVE POWER (DB)	ELEVATION ANGLE (DEG)	DIRECTIVITY (NUMERIC)	DIRECTIVITY (DBI)	RELATIVE POWER (DB)
0	0.00000	-INFINITY	-INFINITY	92.0	1.38371	1.41044	-0.00344
2.0	0.00246	-26.09575	-27.50963	94.0	1.38054	1.40050	-0.01339
4.0	0.00980	-20.08621	-21.50010	96.0	1.37530	1.38398	-0.02991
6.0	0.02196	-16.58281	-17.99669	98.0	1.36797	1.36076	-0.05313
8.0	0.03882	-14.10977	-15.52365	100.0	1.35853	1.33068	-0.08321
10.0	0.06019	-12.20456	-13.61845	102.0	1.34895	1.29352	-0.12037
12.0	0.08588	-10.66113	-12.07501	104.0	1.33322	1.24901	-0.16487
14.0	0.11562	-9.36949	-10.78337	106.0	1.31730	1.19685	-0.21704
16.0	0.14914	-8.26396	-9.67785	108.0	1.29917	1.13665	-0.27723
18.0	0.18612	-7.30212	-8.71601	110.0	1.27879	1.06801	-0.34588
20.0	0.22621	-6.45496	-7.86885	112.0	1.25616	0.99044	-0.42344
22.0	0.26905	-5.70173	-7.11562	114.0	1.23124	0.90343	-0.51046
24.0	0.31426	-5.02708	-6.44096	116.0	1.20403	0.80638	-0.60751
26.0	0.36147	-4.41928	-5.83317	118.0	1.17453	0.69863	-0.71525
28.0	0.41028	-3.86919	-5.28307	120.0	1.14274	0.57948	-0.83440
30.0	0.46031	-3.36949	-4.78338	122.0	1.10870	0.44814	-0.96574
32.0	0.51118	-2.91427	-4.32815	124.0	1.07244	0.30374	-1.11014
34.0	0.56252	-2.49862	-3.91250	126.0	1.03403	0.14534	-1.26855
36.0	0.61398	-2.11844	-3.53233	128.0	0.99355	-0.02812	-1.44200
38.0	0.66523	-1.77028	-3.18416	130.0	0.95109	-0.21778	-1.63166
40.0	0.71596	-1.45114	-2.86502	132.0	0.90680	-0.42491	-1.83879
42.0	0.76587	-1.15846	-2.57234	134.0	0.86081	-0.65091	-2.06480
44.0	0.81471	-0.88998	-2.30386	136.0	0.81332	-0.89737	-2.31126
46.0	0.86224	-0.64372	-2.05760	138.0	0.76453	-1.16604	-2.57993
48.0	0.90826	-0.41792	-1.83180	140.0	0.71468	-1.45890	-2.87278
50.0	0.95257	-0.21102	-1.62490	142.0	0.66402	-1.77820	-3.19209
52.0	0.99504	-0.02160	-1.43548	144.0	0.61284	-2.12652	-3.54041
54.0	1.03553	0.15161	-1.26227	146.0	0.56146	-2.50684	-3.92072
56.0	1.07393	0.30975	-1.10413	148.0	0.51020	-2.92262	-4.33650
58.0	1.11017	0.45388	-0.96001	150.0	0.45941	-3.37796	-4.79185
60.0	1.14418	0.58493	-0.82895	152.0	0.40947	-3.87777	-5.29165
62.0	1.17592	0.70378	-0.71010	154.0	0.36075	-4.42797	-5.84185
64.0	1.20537	0.81122	-0.60267	156.0	0.31363	-5.03586	-6.44974
66.0	1.23252	0.90795	-0.50594	158.0	0.26850	-5.71060	-7.12448
68.0	1.25737	0.99463	-0.41926	160.0	0.22574	-6.46390	-7.87778
70.0	1.27993	1.07185	-0.34204	162.0	0.18573	-7.31113	-8.72501
72.0	1.30021	1.14014	-0.27375	164.0	0.14883	-8.27303	-9.68691
74.0	1.31825	1.19997	-0.21391	166.0	0.11538	-9.37861	-10.79249
76.0	1.33406	1.25177	-0.16212	168.0	0.08570	-10.67029	-12.08417
78.0	1.34769	1.29589	-0.11799	170.0	0.06007	-12.21376	-13.62765
80.0	1.35915	1.33267	-0.08122	172.0	0.03873	-14.11900	-15.53288
82.0	1.36847	1.36236	-0.05153	174.0	0.02192	-16.59206	-18.00595
84.0	1.37568	1.38518	-0.02871	176.0	0.00978	-20.09548	-21.50937
86.0	1.38080	1.40130	-0.01258	178.0	0.00245	-26.51891	-27.51891
88.0	1.38384	1.41085	-0.00304	180.0	0.00000	-INFINITY	-INFINITY
90.0	1.38480	1.41488	0.0				

TABLE A1-33

INTEGRAL EQUATION METHOD
 EPSILON= 1.7500(NORMALIZED GROUNDPLANE RADIUS)
 MONOPOLE LENGTH= 0.025000(WAVELENGTH)
 INFINITELY THIN MONOPOLE RADIUS
 RADIATION RESISTANCE = 0.139354 (OHMS)

ELEVATION ANGLE (DEG)	DIRECTIVITY (NUMERIC)	DIRECTIVITY (DBI)	RELATIVE POWER (DB)	ELEVATION ANGLE (DEG)	DIRECTIVITY (NUMERIC)	DIRECTIVITY (DBI)	RELATIVE POWER (DB)
0	0.00000	-INFINITY	-INFINITY	92.0	1.33167	1.24398	-0.00270
2 0	0.00279	-25.54439	-26.79107	94.0	1.32944	1.23668	-0.01001
4 0	0.01112	-19.53725	-20.78394	96.0	1.32577	1.22469	-0.02200
6 0	0.02490	-16.03782	-17.28451	98.0	1.32065	1.20787	-0.03882
8 0	0.04395	-13.57033	-14.81702	100.0	1.31401	1.18600	-0.06069
10 0	0.06804	-11.67223	-12.91892	102.0	1.30582	1.15882	-0.08787
12 0	0.09689	-10.13742	-11.38410	104.0	1.29598	1.12600	-0.12069
14 0	0.13014	-8.85589	-10.10258	106.0	1.28444	1.08715	-0.15954
16 0	0.16742	-7.76193	-9.00862	108.0	1.27111	1.04182	-0.20487
18 0	0.20830	-6.81307	-8.05976	110.0	1.25589	0.98950	-0.25718
20 0	0.25233	-5.98024	-7.22693	112.0	1.23869	0.92963	-0.31706
22 0	0.29904	-5.24266	-6.48934	114.0	1.21943	0.86155	-0.38513
24 0	0.34795	-4.58488	-5.83157	116.0	1.19801	0.78459	-0.46210
26 0	0.39855	-3.99514	-5.24182	118.0	1.17435	0.69796	-0.54872
28 0	0.45038	-3.46420	-4.71088	120.0	1.14838	0.60084	-0.64584
30 0	0.50296	-2.98468	-4.23137	122.0	1.12004	0.49232	-0.75437
32 0	0.55583	-2.55058	-3.79726	124.0	1.08928	0.37140	-0.87529
34 0	0.60857	-2.15690	-3.40358	126.0	1.05609	0.23700	-1.00968
36 0	0.66078	-1.79945	-3.04614	128.0	1.02046	0.08797	-1.15871
38 0	0.71209	-1.47467	-2.72136	130.0	0.98243	-0.07698	-1.32366
40 0	0.76217	-1.17948	-2.42617	132.0	0.94205	-0.25924	-1.50593
42 0	0.81074	-0.91119	-2.15788	134.0	0.89942	-0.46035	-1.70704
44 0	0.85754	-0.66744	-1.91412	136.0	0.85467	-0.68200	-1.92869
46 0	0.90238	-0.44613	-1.69281	138.0	0.80797	-0.92607	-2.17276
48 0	0.94507	-0.24538	-1.49207	140.0	0.75951	-1.19465	-2.44134
50 0	0.98548	-0.06351	-1.31020	142.0	0.70956	-1.49011	-2.73680
52 0	1.02353	0.10101	-1.14567	144.0	0.65839	-1.81514	-3.06182
54 0	1.05915	0.24959	-0.99709	146.0	0.60634	-2.17280	-3.41949
56 0	1.09232	0.38350	-0.86319	148.0	0.55377	-2.56669	-3.81337
58 0	1.12303	0.50391	-0.74278	150.0	0.50107	-3.00098	-4.24766
60 0	1.15130	0.61189	-0.63479	152.0	0.44868	-3.48066	-4.72734
62 0	1.17718	0.70844	-0.53824	154.0	0.39703	-4.01174	-5.25843
64 0	1.20073	0.79447	-0.45222	156.0	0.34661	-4.60162	-5.84831
66 0	1.22203	0.87080	-0.37586	158.0	0.29788	-5.25952	-6.50620
68 0	1.24114	0.93822	-0.30847	160.0	0.25135	-5.99721	-7.24390
70 0	1.25817	0.99741	-0.24928	162.0	0.20749	-6.83013	-8.07681
72 0	1.27321	1.04902	-0.19767	164.0	0.16676	-7.77907	-9.02576
74 0	1.28636	1.09361	-0.15308	166.0	0.12963	-8.87310	-10.11979
76 0	1.29769	1.13170	-0.11498	168.0	0.09650	-10.15468	-11.40137
78 0	1.30730	1.16375	-0.08294	170.0	0.06777	-11.68954	-12.93623
80 0	1.31527	1.19013	-0.05655	172.0	0.04378	-13.58769	-14.83437
82 0	1.32166	1.21119	-0.03549	174.0	0.02480	-16.05521	-17.30189
84 0	1.32654	1.22720	-0.01949	176.0	0.01108	-19.55465	-20.80134
86 0	1.32995	1.23836	-0.00833	178.0	0.00278	-25.56180	-26.80849
88 0	1.33193	1.24482	-0.00187	180.0	0.00000	-INFINITY	-INFINITY
90 0	1.33250	1.24669	0 0				

TABLE A1-34

INTEGRAL EQUATION METHOD
 EPSILON= 2.000(NORMALIZED GROUNDPLANE RADIUS)
 MONOPOLE LENGTH= 0.025000(WAVELENGTH)
 INFINITELY THIN MONOPOLE RADIUS
 RADIATION RESISTANCE = 0.147191 (OHMS)

ELEVATION ANGLE (DEG)	DIRECTIVITY (NUMERIC)	DIRECTIVITY (DBI)	RELATIVE POWER (DB)	ELEVATION ANGLE (DEG)	DIRECTIVITY (NUMERIC)	DIRECTIVITY (DBI)	RELATIVE POWER (DB)
0	0.0000	-INFINITY	-INFINITY	92	1.26105	1.00733	-0.00173
2	0.00328	-24.83551	-25.84458	94	1.25999	1.00368	-0.00539
4	0.01309	-18.83135	-19.84042	96	1.25834	0.99798	-0.01109
6	0.02926	-15.33688	-16.34595	98	1.25604	0.99005	-0.01902
8	0.05157	-12.87631	-13.88538	100	1.25303	0.97960	-0.02946
10	0.07967	-10.98706	-11.99613	102	1.24919	0.96629	-0.04277
12	0.11316	-9.46302	-10.47209	104	1.24443	0.94969	-0.05938
14	0.15156	-8.19414	-9.20321	106	1.23859	0.92929	-0.07978
16	0.19433	-7.11466	-8.12373	108	1.23155	0.90451	-0.10456
18	0.24088	-6.18207	-7.19114	110	1.22312	0.87469	-0.13438
20	0.29059	-5.36726	-6.37633	112	1.21314	0.83912	-0.16995
22	0.34282	-4.64936	-5.65842	114	1.20143	0.79699	-0.21208
24	0.39693	-4.01288	-5.02195	116	1.18780	0.74744	-0.26163
26	0.45228	-3.44597	-4.45504	118	1.17207	0.68953	-0.31953
28	0.50824	-2.93932	-3.94839	120	1.15405	0.62225	-0.38682
30	0.56423	-2.48547	-3.49454	122	1.13358	0.54451	-0.46456
32	0.61968	-2.07830	-3.08737	124	1.11049	0.45514	-0.55393
34	0.67410	-1.71273	-2.72180	126	1.08465	0.35288	-0.65618
36	0.72703	-1.38447	-2.39354	128	1.05594	0.23640	-0.77267
38	0.77807	-1.08982	-2.09889	130	1.02429	0.10424	-0.90483
40	0.82688	-0.82559	-1.83466	132	0.98966	-0.04516	-1.05423
42	0.87318	-0.58896	-1.59802	134	0.95203	-0.21350	-1.22257
44	0.91676	-0.37743	-1.38650	136	0.91146	-0.40262	-1.41169
46	0.95747	-0.18877	-1.19783	138	0.86805	-0.61457	-1.62363
48	0.99519	-0.02094	-1.03001	140	0.82195	-0.85157	-1.86063
50	1.02989	0.12789	-0.88117	142	0.77337	-1.11613	-2.12520
52	1.06156	0.25943	-0.74964	144	0.72259	-1.41107	-2.42013
54	1.09024	0.37523	-0.63384	146	0.66995	-1.73959	-2.74865
56	1.11603	0.47674	-0.53233	148	0.61583	-2.10538	-3.11444
58	1.13902	0.56530	-0.44376	150	0.56069	-2.51274	-3.52181
60	1.15936	0.64217	-0.36689	152	0.50504	-2.96676	-3.97583
62	1.17720	0.70852	-0.30055	154	0.44941	-3.47355	-4.48262
64	1.19273	0.76542	-0.24365	156	0.39440	-4.04059	-5.04965
66	1.20612	0.81390	-0.19517	158	0.34063	-4.67717	-5.68624
68	1.21756	0.85489	-0.15418	160	0.28872	-5.39516	-6.40423
70	1.22723	0.88926	-0.11980	162	0.23933	-6.21005	-7.21912
72	1.23533	0.91782	-0.09125	164	0.19308	-7.14270	-8.15177
74	1.24202	0.94129	-0.06778	166	0.15058	-8.22223	-9.23130
76	1.24747	0.96032	-0.04875	168	0.11243	-9.49115	-10.50021
78	1.25184	0.97550	-0.03357	170	0.07915	-11.01522	-12.02429
80	1.25526	0.98734	-0.02172	172	0.05123	-12.90450	-13.91356
82	1.25785	0.99629	-0.01378	174	0.02907	-15.35509	-16.37415
84	1.25970	1.00269	-0.00638	176	0.01300	-18.85957	-19.86864
86	1.26091	1.00683	-0.00224	178	0.00326	-24.86374	-25.87280
88	1.26151	1.00891	-0.00015	180	0.00000	-INFINITY	-INFINITY
90	1.26156	1.00907	0				

TABLE A1-35

INTEGRAL EQUATION METHOD
 EPSILON= 2.2500(NORMALIZED GROUNDPLANE RADIUS)
 MONOPOLE LENGTH= 0.025000(WAVELENGTH)
 INFINITELY THIN MONOPOLE RADIUS
 RADIATION RESISTANCE = 0.159189 (OHMS)

ELEVATION ANGLE (DEG)	DIRECTIVITY (NUMERIC)	DIRECTIVITY (DB)	RELATIVE POWER (DB)	ELEVATION ANGLE (DEG)	DIRECTIVITY (NUMERIC)	DIRECTIVITY (DB)	RELATIVE POWER (DB)
0	0.00000	-INFINITY	-INFINITY	92.0	1.16637	0.66835	-0.06255
2.0	0.00402	-23.95498	-24.68588	94.0	1.16676	0.66983	-0.06107
4.0	0.01602	-17.95436	-18.68527	96.0	1.16762	0.67303	-0.05787
6.0	0.03576	-14.46579	-15.19669	98.0	1.16887	0.67767	-0.05323
8.0	0.06290	-10.13477	-12.74436	100.0	1.17040	0.68336	-0.04754
10.0	0.09694	-8.62357	-9.35447	102.0	1.17208	0.68959	-0.04131
12.0	0.13729	-7.36981	-8.10071	104.0	1.17375	0.69575	-0.03515
14.0	0.18324	-6.30767	-7.03857	106.0	1.17521	0.70114	-0.02976
16.0	0.23401	-5.39461	-6.12551	108.0	1.17624	0.70496	-0.02594
18.0	0.28876	-4.60145	-5.33235	110.0	1.17660	0.70631	-0.02459
20.0	0.34662	-3.90729	-4.63819	112.0	1.17604	0.70421	-0.02669
22.0	0.40670	-3.29656	-4.02746	114.0	1.17425	0.69762	-0.03328
24.0	0.46811	-2.75735	-3.48825	116.0	1.17095	0.68539	-0.04551
26.0	0.52999	-2.28027	-3.01118	118.0	1.16582	0.66633	-0.06457
28.0	0.59152	-1.85777	-2.58867	120.0	1.15855	0.63915	-0.09175
30.0	0.65196	-1.48365	-2.21455	122.0	1.14882	0.60251	-0.12839
32.0	0.71062	-1.15272	-1.88362	124.0	1.13631	0.55499	-0.17592
34.0	0.76688	-0.86057	-1.59147	126.0	1.12075	0.49508	-0.23582
36.0	0.82024	-0.60339	-1.33429	128.0	1.10184	0.42120	-0.30970
38.0	0.87028	-0.37786	-1.10876	130.0	1.07937	0.33169	-0.39921
40.0	0.91667	-0.18102	-0.91192	132.0	1.05311	0.22475	-0.50615
42.0	0.95918	-0.01022	-0.74112	134.0	1.02294	0.09850	-0.63240
44.0	0.99765	0.13694	-0.59396	136.0	0.98876	-0.04910	-0.78000
46.0	1.03203	0.26266	-0.46824	138.0	0.95054	-0.22028	-0.95118
48.0	1.06235	0.36897	-0.36193	140.0	0.90836	-0.41742	-1.14832
50.0	1.08867	0.45776	-0.27314	142.0	0.86234	-0.64320	-1.37410
52.0	1.11116	0.53081	-0.20009	144.0	0.81272	-0.90057	-1.63147
54.0	1.13001	0.58978	-0.14112	146.0	0.75982	-1.19287	-1.92377
56.0	1.14546	0.63625	-0.09465	148.0	0.70406	-1.52391	-2.25481
58.0	1.15778	0.67170	-0.05920	150.0	0.64594	-1.89810	-2.62900
60.0	1.16727	0.69756	-0.03334	152.0	0.58605	-2.32065	-3.05155
62.0	1.17424	0.71517	-0.01573	154.0	0.52508	-2.79775	-3.52865
64.0	1.17901	0.72581	-0.00509	156.0	0.46377	-3.33696	-4.06786
66.0	1.18190	0.73067	0.00023	158.0	0.40293	-3.94767	-4.67857
68.0	1.18322	0.73090	0.00000	160.0	0.34341	-4.64181	-5.37271
70.0	1.18329	0.72755	-0.00335	162.0	0.28609	-5.43493	-6.16583
72.0	1.18237	0.72160	-0.00930	164.0	0.23185	-6.34796	-7.07886
74.0	1.18076	0.71396	-0.01694	166.0	0.18155	-7.41006	-8.14096
76.0	1.17868	0.70542	-0.02548	168.0	0.13603	-8.66378	-9.39468
78.0	1.17637	0.69672	-0.03418	170.0	0.09605	-10.17494	-10.90584
80.0	1.17401	0.68848	-0.04242	172.0	0.06232	-12.05360	-12.78450
82.0	1.17178	0.68120	-0.04970	174.0	0.03543	-14.50591	-15.23681
84.0	1.16982	0.67531	-0.05559	176.0	0.01587	-17.99447	-18.72537
86.0	1.16824	0.67110	-0.05980	178.0	0.00399	-23.99507	-24.72597
88.0	1.16711	0.66876	-0.06214	180.0	0.00000	-INFINITY	-INFINITY
90.0	1.16648						

TABLE A1-36

INTEGRAL EQUATION METHOD
 EPSILON= 2.5000(NORMALIZED GROUNDPLANE RADIUS)
 MONOPOLE LENGTH= 0.025000(WAVELENGTH)
 INFINITELY THIN MONOPOLE RADIUS
 RADIATION RESISTANCE = 0.178038 (OHMS)

ELEVATION ANGLE (DEG)	DIRECTIVITY (NUMERIC)	DIRECTIVITY (DBI)	RELATIVE POWER (DB)	ELEVATION ANGLE (DEG)	DIRECTIVITY (NUMERIC)	DIRECTIVITY (DBI)	RELATIVE POWER (DB)
0	0.00000	-INFINITY	-INFINITY	92.0	1.04333	0.18423	-0.53288
2.0	0.00511	-22.91583	-23.63294	94.0	1.04546	0.19309	-0.52402
4.0	0.02033	-16.91920	-17.63631	96.0	1.04932	0.20907	-0.50805
6.0	0.04532	-13.43726	-14.15437	98.0	1.05480	0.23171	-0.48540
8.0	0.07954	-10.99419	-11.71130	100.0	1.06180	0.26041	-0.45670
10.0	0.12225	-9.12739	-9.84450	102.0	1.07013	0.28437	-0.42274
12.0	0.17256	-7.63068	-8.34780	104.0	1.07960	0.33265	-0.38447
14.0	0.22940	-6.39400	-7.11111	106.0	1.08997	0.37416	-0.34295
16.0	0.29164	-5.35148	-6.06859	108.0	1.10096	0.41772	-0.29939
18.0	0.35805	-4.46056	-5.17767	110.0	1.11225	0.46202	-0.25509
20.0	0.42736	-3.69203	-4.40914	112.0	1.12348	0.50564	-0.21147
22.0	0.49832	-3.02493	-3.74204	114.0	1.13426	0.54712	-0.16999
24.0	0.56968	-2.44365	-3.16077	116.0	1.14417	0.58490	-0.13221
26.0	0.64029	-1.93623	-2.65334	118.0	1.15276	0.61738	-0.09974
28.0	0.70905	-1.49321	-2.21033	120.0	1.15955	0.64288	-0.07423
30.0	0.77500	-1.10698	-1.82409	122.0	1.16404	0.65970	-0.05742
32.0	0.83729	-0.77126	-1.48837	124.0	1.16575	0.66606	-0.05105
34.0	0.89520	-0.48078	-1.19789	126.0	1.16417	0.66017	-0.05695
36.0	0.94819	-0.23103	-0.94814	128.0	1.15881	0.64013	-0.07699
38.0	0.99584	-0.01811	-0.73522	130.0	1.14921	0.60400	-0.11311
40.0	1.03787	0.16142	-0.55569	132.0	1.13495	0.54977	-0.16734
42.0	1.07415	0.31066	-0.40645	134.0	1.11566	0.47531	-0.24180
44.0	1.10468	0.43238	-0.28473	136.0	1.09104	0.37839	-0.33872
46.0	1.12957	0.52915	-0.18797	138.0	1.06087	0.25660	-0.46051
48.0	1.14904	0.60334	-0.11378	140.0	1.02504	0.10739	-0.60972
50.0	1.16337	0.65717	-0.05994	142.0	0.98354	-0.07206	-0.78917
52.0	1.17294	0.69276	-0.02436	144.0	0.93652	-0.28484	-1.00195
54.0	1.17817	0.71209	-0.00502	146.0	0.88422	-0.53440	-1.25151
56.0	1.17954	0.71711	0.0	148.0	0.82705	-0.82466	-1.54178
58.0	1.17752	0.70967	-0.00745	150.0	0.76557	-1.16014	-1.87726
60.0	1.17262	0.69156	-0.02556	152.0	0.70047	-1.54611	-2.26323
62.0	1.16534	0.66453	-0.05258	154.0	0.63258	-1.98886	-2.70598
64.0	1.15619	0.63029	-0.08682	156.0	0.56286	-2.49601	-3.21313
66.0	1.14564	0.59048	-0.12663	158.0	0.49238	-3.07702	-3.79413
68.0	1.13415	0.54671	-0.17041	160.0	0.42229	-3.74386	-4.46097
70.0	1.12215	0.50051	-0.21660	162.0	0.35382	-4.51215	-5.22926
72.0	1.11003	0.45337	-0.26375	164.0	0.28821	-5.40284	-6.11995
74.0	1.09817	0.40668	-0.31043	166.0	0.22672	-6.44514	-7.16225
76.0	1.08687	0.36178	-0.35533	168.0	0.17054	-7.68164	-8.39875
78.0	1.07643	0.31987	-0.39725	170.0	0.12083	-9.17818	-9.89529
80.0	1.06710	0.28204	-0.43507	172.0	0.07862	-11.04484	-11.76196
82.0	1.05908	0.24928	-0.46783	174.0	0.04479	-13.48781	-14.20492
84.0	1.05254	0.22240	-0.49472	176.0	0.02009	-16.96967	-17.68678
86.0	1.04762	0.20205	-0.51506	178.0	0.00505	-22.96626	-23.68337
88.0	1.04432	0.18874	-0.52837	180.0	0.00000	-INFINITY	-INFINITY
90.0	1.04298	0.18276	-0.53435				

TABLE A1-37

INTEGRAL EQUATION METHOD
 EPSILON= 2.7500(NORMALIZED GROUNDPLANE RADIUS)
 MONOPOLE LENGTH= 0.025000(WAVELENGTH)
 INFINITELY THIN MONOPOLE RADIUS
 RADIATION RESISTANCE = 0.208486 (DHMS)

ELEVATION ANGLE θ (DEG)	DIRECTIVITY (NUMERIC)	DIRECTIVITY (DBI)	RELATIVE POWER (DB)	ELEVATION ANGLE (DEG)	DIRECTIVITY (NUMERIC)	DIRECTIVITY (DBI)	RELATIVE POWER (DB)
0.	0.00000	-INFINITY	-INFINITY	92.0	0.88914	-0.51032	-1.95497
2.0	1.39465	1.44466	0.0	94.0	0.89079	-0.50225	-1.94691
4.0	0.34114	-4.67071	-6.11536	96.0	0.89557	-0.47900	-1.92365
6.0	0.14821	-8.29136	-9.73601	98.0	0.90340	-0.44119	-1.88584
8.0	0.08140	-10.89369	-12.33834	100.0	0.91415	-0.38980	-1.83446
10.0	0.05080	-12.94094	-14.38559	102.0	0.92766	-0.32610	-1.77075
12.0	0.03436	-14.63996	-16.08462	104.0	0.94372	-0.25158	-1.69624
14.0	0.02454	-16.10166	-17.54632	106.0	0.96206	-0.16798	-1.61263
16.0	0.01823	-17.39279	-18.83744	108.0	0.98239	-0.07717	-1.52183
18.0	0.01394	-18.55701	-20.00167	110.0	1.00434	0.01880	-1.42585
20.0	0.01090	-19.62483	-21.06949	112.0	1.02751	0.11784	-1.32681
22.0	0.00867	-20.61878	-22.06344	114.0	1.05142	0.21776	-1.22689
24.0	0.00699	-21.55640	-23.00106	116.0	1.07556	0.31635	-1.12830
26.0	0.00569	-22.45210	-23.89675	118.0	1.09916	0.41138	-1.03327
28.0	0.00466	-23.31838	-24.76304	120.0	1.12218	0.50062	-0.94403
30.0	0.00383	-24.16884	-25.61150	122.0	1.14336	0.58183	-0.86282
32.0	0.00316	-25.00896	-26.45362	124.0	1.16220	0.65280	-0.79186
34.0	0.00260	-25.85701	-27.30167	126.0	1.17795	0.71128	-0.73338
36.0	0.00213	-26.72516	-28.16981	128.0	1.18988	0.75504	-0.68962
38.0	0.00173	-27.63106	-29.07572	130.0	1.19724	0.78182	-0.65283
40.0	0.00138	-28.59860	-30.04325	132.0	1.19931	0.78933	-0.62533
42.0	0.00108	-29.66287	-31.10753	134.0	1.19542	0.77520	-0.60945
44.0	0.00082	-30.88082	-32.32548	136.0	1.18495	0.73699	-0.70766
46.0	0.00058	-32.35716	-33.80181	138.0	1.16738	0.67213	-0.77252
48.0	0.00037	-34.32462	-35.76927	140.0	1.14232	0.57790	-0.86676
50.0	0.00018	-37.52247	-38.96713	142.0	1.10952	0.45134	-0.99331
52.0	1.27923	1.06948	-0.37518	144.0	1.06887	0.28926	-1.15539
54.0	1.26582	1.02373	-0.42092	146.0	1.02049	0.08810	-1.35655
56.0	1.24803	0.96224	-0.48242	148.0	0.96468	-0.15615	-1.60081
58.0	1.22662	0.88709	-0.55757	150.0	0.90197	-0.44808	-1.89274
60.0	1.20236	0.80035	-0.64431	152.0	0.83310	-0.79304	-2.23770
62.0	1.17601	0.70411	-0.74055	154.0	0.75904	-1.19738	-2.64203
64.0	1.14827	0.60044	-0.84422	156.0	0.68096	-1.66876	-3.11342
66.0	1.11981	0.49143	-0.95322	158.0	0.60025	-2.21670	-3.66135
68.0	1.09124	0.37919	-1.06547	160.0	0.51842	-2.85321	-4.29787
70.0	1.06312	0.26581	-1.17884	162.0	0.43712	-3.59395	-5.03860
72.0	1.03595	0.15340	-1.21266	164.0	0.35810	-4.45990	-5.90456
74.0	1.01019	0.04402	-1.40063	166.0	0.28312	-5.48031	-6.92496
76.0	0.98622	-0.06028	-1.50494	168.0	0.21391	-6.69778	-8.14244
78.0	0.96437	-0.15756	-1.60222	170.0	0.15212	-8.17818	-9.62284
80.0	0.94494	-0.24598	-1.69063	172.0	0.09927	-10.03162	-11.47628
82.0	0.92815	-0.32381	-1.76817	174.0	0.05670	-12.46428	-13.90894
84.0	0.91420	-0.39457	-1.83422	176.0	0.02548	-15.93878	-17.38343
86.0	0.90124	-0.44195	-1.88661	178.0	0.00641	-21.93094	-23.37560
88.0	0.89517	-0.47496	-1.92461	180.	0.00000	-INFINITY	-INFINITY
90.0	0.89066	-0.50287	-1.94753				

TABLE A1-38

INTEGRAL EQUATION METHOD
 EPSILDN= 0.0 (NORMALIZED GROUNDPLANE RADIUS)
 MONOPOLE LENGTH= 0.010000(WAVELENGTH)
 INFINITELY THIN MONOPOLE RADIUS
 RADIATION RESISTANCE = 0.019738 (OHMS)

ELEVATION ANGLE (DEG)	DIRECTIVITY (NUMERIC)	DIRECTIVITY (DB)	RELATIVE POWER (DB)	ELEVATION ANGLE (DEG)	DIRECTIVITY (NUMERIC)	DIRECTIVITY (DB)	RELATIVE POWER (DB)
0.	0.00000	-INFINITY	-INFINITY	92.0	1.49824	1.75581	-0.00529
2.0	0.00183	-27.38347	-29.14457	94.0	1.49276	1.73991	-0.02119
4.0	0.00730	-21.36815	-23.12926	96.0	1.48367	1.71338	-0.04772
6.0	0.01639	-17.85515	-19.61625	98.0	1.47100	1.67614	-0.08496
8.0	0.02905	-15.36873	-17.12983	100.0	1.45482	1.62810	-0.13300
10.0	0.04522	-13.44642	-15.20752	102.0	1.43521	1.56915	-0.19195
12.0	0.06483	-11.88223	-13.64333	104.0	1.41225	1.49913	-0.26197
14.0	0.08778	-10.56629	-12.32739	106.0	1.38607	1.41786	-0.34324
16.0	0.11395	-9.43302	-11.19412	108.0	1.35679	1.32514	-0.43596
18.0	0.14322	-8.44011	-10.20121	110.0	1.32456	1.22071	-0.54040
20.0	0.17544	-7.55870	-9.31981	112.0	1.28952	1.10429	-0.65682
22.0	0.21046	-6.76821	-8.52931	114.0	1.25186	0.97555	-0.78555
24.0	0.24812	-6.05343	-7.81453	116.0	1.21175	0.83412	-0.92698
26.0	0.28822	-5.40283	-7.16393	118.0	1.16939	0.67959	-1.08151
28.0	0.33056	-4.80745	-6.56856	120.0	1.12499	0.51148	-1.24963
30.0	0.37495	-4.26021	-6.02131	122.0	1.07876	0.32925	-1.43186
32.0	0.42117	-3.75539	-5.51649	124.0	1.03093	0.13229	-1.62881
34.0	0.46899	-3.28832	-5.04942	126.0	0.98173	-0.08007	-1.84118
36.0	0.51819	-2.85515	-4.61625	128.0	0.93140	-0.30862	-2.06972
38.0	0.56851	-2.45265	-4.21375	130.0	0.88019	-0.55421	-2.31531
40.0	0.61971	-2.07811	-3.83921	132.0	0.82835	-0.81785	-2.57896
42.0	0.67155	-1.72921	-3.49031	134.0	0.77613	-1.10067	-2.86178
44.0	0.72377	-1.40396	-3.16507	136.0	0.72377	-1.40396	-3.16507
46.0	0.77613	-1.10067	-2.86178	138.0	0.67155	-1.72921	-3.49031
48.0	0.82835	-0.81785	-2.57896	140.0	0.61971	-2.07811	-3.83921
50.0	0.88019	-0.55421	-2.31531	142.0	0.56851	-2.45265	-4.21375
52.0	0.93140	-0.30862	-2.06972	144.0	0.51819	-2.85515	-4.61625
54.0	0.98173	-0.08007	-1.84118	146.0	0.46899	-3.28832	-5.04942
56.0	1.03093	0.13229	-1.62881	148.0	0.42117	-3.75539	-5.51649
58.0	1.07876	0.32925	-1.43186	150.0	0.37495	-4.26021	-6.02131
60.0	1.12499	0.51148	-1.24963	152.0	0.33056	-4.80745	-6.56856
62.0	1.16939	0.67959	-1.08151	154.0	0.28822	-5.40283	-7.16393
64.0	1.21175	0.83412	-0.92698	156.0	0.24812	-6.05343	-7.81453
66.0	1.25186	0.97555	-0.78555	158.0	0.21046	-6.76821	-8.52931
68.0	1.28952	1.10429	-0.65682	160.0	0.17544	-7.55870	-9.31981
70.0	1.32456	1.22071	-0.54040	162.0	0.14322	-8.44011	-10.20121
72.0	1.35679	1.32514	-0.43596	164.0	0.11395	-9.43302	-11.19412
74.0	1.38607	1.41786	-0.34324	166.0	0.08778	-10.56629	-12.32739
76.0	1.41225	1.49913	-0.26197	168.0	0.06483	-11.88223	-13.64333
78.0	1.43521	1.56915	-0.19195	170.0	0.04522	-13.44642	-15.20752
80.0	1.45482	1.62810	-0.13300	172.0	0.02905	-15.36873	-17.12983
82.0	1.47100	1.67614	-0.08496	174.0	0.01639	-17.85515	-19.61625
84.0	1.48367	1.71338	-0.04772	176.0	0.00730	-21.36815	-23.12926
86.0	1.49276	1.73991	-0.02119	178.0	0.00183	-27.38347	-29.14457
88.0	1.49824	1.75581	-0.00529	180.0	0.00000	-INFINITY	-INFINITY
90.0	1.50007	1.76110	0.0				

TABLE A1-39

INTEGRAL EQUATION METHOD
 EPSILON= 0.2500(NORMALIZED GROUNDPLANE RADIUS)
 MONDPOLE LENGTH= 0.010000(WAVELENGTH)
 INFINITELY THIN MONDPOLE RADIUS
 RADIATION RESISTANCE = 0.019769 (OHMS)

ELEVATION ANGLE (DEG)	DIRECTIVITY (NUMERIC)	DIRECTIVITY (DBI)	RELATIVE POWER (DB)	ELEVATION ANGLE (DEG)	DIRECTIVITY (NUMERIC)	DIRECTIVITY (DBI)	RELATIVE POWER (DB)
0	0.00000	-INFINITY	-INFINITY	92.0	1.49585	1.74889	-0.00525
2.0	0.00184	-27.35570	-29.10984	94.0	1.49043	1.73312	-0.02102
4.0	0.00734	-27.34052	-23.09466	96.0	1.48143	1.70680	-0.04734
6.0	0.01649	-17.27772	-19.58186	98.0	1.46888	1.66985	-0.08429
8.0	0.02923	-15.34159	-17.09574	100.0	1.45284	1.62219	-0.13195
10.0	0.04550	-13.41966	-15.17380	102.0	1.43341	1.56369	-0.19045
12.0	0.06522	-11.85593	-13.61007	104.0	1.41055	1.49420	-0.25994
14.0	0.08830	-10.54052	-12.29466	106.0	1.38470	1.41355	-0.34060
16.0	0.11461	-9.40785	-11.16199	108.0	1.35566	1.32150	-0.43264
18.0	0.14402	-8.41562	-10.16977	110.0	1.32368	1.21782	-0.53633
20.0	0.17640	-7.53496	-9.28911	112.0	1.28890	1.10221	-0.65194
22.0	0.21158	-6.74528	-8.49942	114.0	1.25151	0.97434	-0.77980
24.0	0.24938	-6.03137	-7.78551	116.0	1.21167	0.83385	-0.92030
26.0	0.28962	-5.38170	-7.13584	118.0	1.16958	0.68030	-1.07385
28.0	0.33210	-4.78731	-6.54145	120.0	1.12544	0.51321	-1.24093
30.0	0.37661	-4.24110	-5.99524	122.0	1.07946	0.33205	-1.42209
32.0	0.42293	-3.73734	-5.49149	124.0	1.03186	0.13620	-1.61794
34.0	0.47083	-3.27138	-5.02553	126.0	0.98287	-0.07502	-1.82916
36.0	0.52007	-2.83935	-4.59349	128.0	0.93274	-0.30240	-2.05654
38.0	0.57042	-2.43802	-4.19216	130.0	0.88170	-0.54681	-2.30095
40.0	0.62163	-2.06466	-3.81881	132.0	0.82959	-0.80925	-2.56339
42.0	0.67345	-1.71696	-3.47111	134.0	0.77788	-1.09086	-2.84500
44.0	0.72562	-1.39293	-3.14708	136.0	0.72562	-1.39293	-3.14708
46.0	0.77788	-1.09086	-2.84500	138.0	0.67345	-1.71696	-3.47111
48.0	0.82959	-0.80925	-2.56339	140.0	0.62163	-2.06466	-3.81881
50.0	0.88170	-0.54680	-2.30095	142.0	0.57042	-2.43802	-4.19216
52.0	0.93274	-0.30240	-2.05654	144.0	0.52007	-2.83935	-4.59349
54.0	0.98287	-0.07502	-1.82916	146.0	0.47083	-3.27138	-5.02553
56.0	1.03186	0.13620	-1.61794	148.0	0.42293	-3.73734	-5.49149
58.0	1.07946	0.33205	-1.42209	150.0	0.37661	-4.24110	-5.99524
60.0	1.12544	0.51321	-1.24093	152.0	0.33210	-4.78731	-6.54145
62.0	1.16958	0.68030	-1.07385	154.0	0.28962	-5.38170	-7.13584
64.0	1.21167	0.83385	-0.92030	156.0	0.24938	-6.03137	-7.78551
66.0	1.25151	0.97434	-0.77980	158.0	0.21158	-6.74528	-8.49942
68.0	1.28890	1.10221	-0.65194	160.0	0.17640	-7.53497	-9.28911
70.0	1.32368	1.21782	-0.53633	162.0	0.14020	-8.41563	-10.16977
72.0	1.35566	1.32150	-0.43264	164.0	0.11461	-9.40785	-11.16199
74.0	1.38470	1.41355	-0.34060	166.0	0.08830	-10.54052	-12.29466
76.0	1.41065	1.49420	-0.25994	168.0	0.06522	-11.85593	-13.61007
78.0	1.43341	1.56369	-0.19045	170.0	0.04550	-13.41966	-15.17380
80.0	1.45284	1.62219	-0.13195	172.0	0.02923	-15.34159	-17.09574
82.0	1.46888	1.66985	-0.08429	174.0	0.01649	-17.27772	-19.58186
84.0	1.48143	1.70680	-0.04734	176.0	0.00734	-21.34052	-23.09466
86.0	1.49043	1.73312	-0.02102	178.0	0.00184	-27.35570	-29.10984
88.0	1.49585	1.74889	-0.00525	180.0	0.00000	-INFINITY	-INFINITY
90.0	1.49766	1.75114	0.0				

TABLE A1-40

INTEGRAL EQUATION METHOD
 EPSILON= 0.5000(NORMALIZED GROUNDPLANE RADIUS)
 MONDPOLE LENGTH= 0.010000(WAVELENGTH)
 INFINITELY THIN MONDPOLE RADIUS
 RADIATION RESISTANCE = 0.019825 (OHMS)

ELEVATION ANGLE (DEG)	DIRECTIVITY (NUMERIC)	DIRECTIVITY (DBI)	RELATIVE POWER (DB)	ELEVATION ANGLE (DEG)	DIRECTIVITY (NUMERIC)	DIRECTIVITY (DBI)	RELATIVE POWER (DB)
0	0.00000	-INFINITY	-INFINITY	92.0	1.49166	1.73670	-0.00518
2.0	0.00186	-27.30677	-29.04865	94.0	1.48633	1.72115	-0.02072
4.0	0.00743	-21.29182	-23.03369	96.0	1.47747	1.69520	-0.04668
6.0	0.01667	-17.77939	-19.52127	98.0	1.46513	1.65877	-0.08311
8.0	0.02955	-15.29378	-17.03566	100.0	1.44936	1.61176	-0.13011
10.0	0.04600	-13.37251	-15.11439	102.0	1.43023	1.55406	-0.18781
12.0	0.06592	-11.80958	-13.55146	104.0	1.40783	1.48551	-0.25637
14.0	0.08923	-10.49511	-12.23699	106.0	1.38226	1.40591	-0.33596
16.0	0.11578	-9.36352	-11.10539	108.0	1.35365	1.31506	-0.42682
18.0	0.14546	-8.37249	-10.11437	110.0	1.32211	1.21269	-0.52919
20.0	0.17811	-7.49315	-9.23503	112.0	1.28781	1.09850	-0.64337
22.0	0.21356	-6.70490	-8.44678	114.0	1.25088	0.97217	-0.76970
24.0	0.25162	-5.99253	-7.73441	116.0	1.21152	0.83331	-0.90856
26.0	0.29211	-5.34451	-7.08638	118.0	1.16990	0.68149	-1.06039
28.0	0.33482	-4.75185	-6.49372	120.0	1.12621	0.51621	-1.22567
30.0	0.37954	-4.20745	-5.94933	122.0	1.08067	0.33693	-1.40494
32.0	0.42603	-3.70559	-5.44747	124.0	1.03348	0.14304	-1.59884
34.0	0.47407	-3.24159	-4.98346	126.0	0.98488	-0.06618	-1.80806
36.0	0.52341	-2.81157	-4.55344	128.0	0.93508	-0.29150	-2.03338
38.0	0.57381	-2.41229	-4.15417	130.0	0.88434	-0.53382	-2.27570
40.0	0.62502	-2.04103	-3.78290	132.0	0.83289	-0.79415	-2.53602
42.0	0.67679	-1.69545	-3.43732	134.0	0.78098	-1.07363	-2.81550
44.0	0.72886	-1.37355	-3.11543	136.0	0.72886	-1.37357	-3.11544
46.0	0.78098	-1.07361	-2.81549	138.0	0.67679	-1.69546	-3.43734
48.0	0.83289	-0.79414	-2.53601	140.0	0.62502	-2.04104	-3.78292
50.0	0.88434	-0.53381	-2.27569	142.0	0.57381	-2.41231	-4.15418
52.0	0.93508	-0.29149	-2.03337	144.0	0.52341	-2.81158	-4.55346
54.0	0.98488	-0.06617	-1.80804	146.0	0.47407	-3.24160	-4.98348
56.0	1.03349	0.14305	-1.59883	148.0	0.42603	-3.70561	-5.44748
58.0	1.08067	0.33694	-1.40493	150.0	0.37954	-4.20747	-5.94935
60.0	1.12622	0.51622	-1.22565	152.0	0.33482	-4.75187	-6.49374
62.0	1.16990	0.68150	-1.06038	154.0	0.29211	-5.3453	-7.08640
64.0	1.21152	0.83332	-0.90856	156.0	0.25162	-5.99255	-7.73443
66.0	1.25089	0.97218	-0.76969	158.0	0.21355	-6.70492	-8.44680
68.0	1.28781	1.09851	-0.64336	160.0	0.17811	-7.49317	-9.23505
70.0	1.32212	1.21269	-0.52918	162.0	0.14546	-8.37251	-10.11439
72.0	1.35365	1.31506	-0.42681	164.0	0.11578	-9.36354	-11.10541
74.0	1.38227	1.40592	-0.33596	166.0	0.08922	-10.49514	-12.23701
76.0	1.40783	1.48551	-0.25636	168.0	0.06592	-11.80960	-13.55148
78.0	1.43023	1.55407	-0.18781	170.0	0.04600	-13.37253	-15.11441
80.0	1.44936	1.61177	-0.13011	172.0	0.02955	-15.29380	-17.03568
82.0	1.46513	1.65877	-0.08311	174.0	0.01667	-17.77941	-19.52129
84.0	1.47747	1.69520	-0.04668	176.0	0.00743	-21.29184	-23.03371
86.0	1.48633	1.72115	-0.02072	178.0	0.00186	-27.30680	-29.04667
88.0	1.49166	1.73670	-0.00518	180.0	0.00000	-INFINITY	-INFINITY
90.0	1.49314	1.74188	0.0				

TABLE A1-41

INTEGRAL EQUATION METHOD
 EPSILON= 0.7500(NORMALIZED GROUNDPLANE RADIUS)
 MONOPOLE LENGTH= 0.010000(WAVELENGTH)
 INFINITELY THIN MONOPOLE RADIUS
 RADIATION RESISTANCE = 0.019871 (OHMS)

ELEVATION ANGLE (DEG)	DIRECTIVITY (NUMERIC)	DIRECTIVITY (DBI)	RELATIVE POWER (DB)	ELEVATION ANGLE (DEG)	DIRECTIVITY (NUMERIC)	DIRECTIVITY (DBI)	RELATIVE POWER (DB)
0	0.00000	-INFINITY	-INFINITY	92.0	1.48825	1.72675	-0.00512
2.0	0.00188	-27.26650	-28.99837	94.0	1.48299	1.71138	-0.02049
4.0	0.00750	-21.25172	-22.98360	96.0	1.47425	1.68572	-0.04615
6.0	0.01683	-17.73961	-19.47148	98.0	1.46208	1.64971	-0.08216
8.0	0.02982	-15.25443	-16.98631	100.0	1.44652	1.60323	-0.12864
10.0	0.04641	-13.33372	-15.06559	102.0	1.42764	1.54618	-0.18570
12.0	0.06650	-11.77146	-13.50333	104.0	1.40552	1.47837	-0.25350
14.0	0.09000	-10.45777	-12.18965	106.0	1.38027	1.39964	-0.33223
16.0	0.11676	-9.32707	-11.05894	108.0	1.35199	1.30975	-0.42212
18.0	0.14665	-8.33704	-10.06891	110.0	1.32082	1.20844	-0.52343
20.0	0.17952	-7.45880	-9.19067	112.0	1.28689	1.09541	-0.63646
22.0	0.21519	-6.67174	-8.40361	114.0	1.25035	0.97032	-0.76155
24.0	0.25347	-5.96066	-7.69253	116.0	1.21137	0.83278	-0.89909
26.0	0.29417	-5.31399	-7.04586	118.0	1.17013	0.68236	-1.04951
28.0	0.33707	-4.72277	-6.45464	120.0	1.12682	0.51855	-1.21332
30.0	0.38196	-4.17988	-5.91175	122.0	1.08164	0.34081	-1.39106
32.0	0.42859	-3.67958	-5.41145	124.0	1.03478	0.14850	-1.58337
34.0	0.47674	-3.21719	-4.94906	126.0	0.98649	-0.05908	-1.79095
36.0	0.52616	-2.78883	-4.52071	128.0	0.93697	-0.28273	-2.01460
38.0	0.57660	-2.39126	-4.12313	130.0	0.88647	-0.52334	-2.25521
40.0	0.62781	-2.02172	-3.75359	132.0	0.83523	-0.78194	-2.51381
42.0	0.67953	-1.67788	-3.40975	134.0	0.78349	-1.05967	-2.79154
44.0	0.73152	-1.35774	-3.08961	136.0	0.73150	-1.35785	-3.08972
46.0	0.78351	-1.05956	-2.79143	138.0	0.67952	-1.67800	-3.40987
48.0	0.83525	-0.78183	-2.51370	140.0	0.62779	-2.02184	-3.75371
50.0	0.88649	-0.52324	-2.25511	142.0	0.57658	-2.39138	-4.12325
52.0	0.93699	-0.28263	-2.01450	144.0	0.52614	-2.78896	-4.52083
54.0	0.98651	-0.05899	-1.79086	146.0	0.47672	-3.21732	-4.94920
56.0	1.03481	0.14859	-1.58328	148.0	0.42858	-3.67971	-5.41159
58.0	1.08166	0.34089	-1.39098	150.0	0.38194	-4.18001	-5.91188
60.0	1.12684	0.51863	-1.21324	152.0	0.33706	-4.72291	-6.45478
62.0	1.17015	0.68243	-1.04944	154.0	0.29416	-5.31413	-7.04600
64.0	1.21139	0.83285	-0.89902	156.0	0.25347	-5.96080	-7.69267
66.0	1.25037	0.97038	-0.76149	158.0	0.21518	-6.67189	-8.40376
68.0	1.28691	1.09547	-0.63640	160.0	0.17952	-7.45895	-9.19082
70.0	1.32084	1.20849	-0.52338	162.0	0.14665	-8.33719	-10.06906
72.0	1.35201	1.30980	-0.42207	164.0	0.11676	-9.32722	-11.05909
74.0	1.38028	1.39968	-0.33219	166.0	0.08999	-10.45793	-12.18980
76.0	1.40553	1.47841	-0.25346	168.0	0.06650	-11.77161	-13.50348
78.0	1.42765	1.54621	-0.18566	170.0	0.04641	-13.33387	-15.06574
80.0	1.44653	1.60326	-0.12861	172.0	0.02982	-15.25459	-16.98646
82.0	1.46209	1.64973	-0.08214	174.0	0.01683	-17.73977	-19.47164
84.0	1.47426	1.68574	-0.04613	176.0	0.00750	-21.25188	-22.98375
86.0	1.48299	1.71139	-0.02048	178.0	0.00188	-27.26666	-28.99853
88.0	1.48825	1.72676	-0.00511	180.0	0.00000	-INFINITY	-INFINITY
90.0	1.49000	1.73187	0.0				

TABLE A1-42

INTEGRAL EQUATION METHOD
 EPSILON= 1.0000(NORMALIZED GROUNDPLANE RADIUS)
 MONDPOLE LENGTH= 0.010000(WAVELENGTH)
 INFINITELY THIN MONDPOLE RADIUS
 RADIATION RESISTANCE = 0.019898 (OHMS)

ELEVATION ANGLE (DEG)	DIRECTIVITY (NUMERIC)	DIRECTIVITY (DBI)	RELATIVE POWER (DB)	ELEVATION ANGLE (DEG)	DIRECTIVITY (NUMERIC)	DIRECTIVITY (DBI)	RELATIVE POWER (DB)
0	0.00000	-INFINITY	-INFINITY	92	1.48622	1.72082	-0.00509
2	0.00189	-27.24179	-28.96770	94	1.48100	1.70555	-0.02036
4	0.00754	-21.22714	-22.95305	96	1.47233	1.68005	-0.04586
6	0.01692	-17.71522	-19.44113	98	1.46025	1.64427	-0.08164
8	0.02999	-15.23031	-16.95622	100	1.44481	1.59810	-0.12781
10	0.04667	-13.30994	-15.03585	102	1.42607	1.54141	-0.18450
12	0.06686	-11.74810	-13.47401	104	1.40412	1.47405	-0.25186
14	0.09047	-10.43491	-12.16082	106	1.37905	1.39581	-0.33010
16	0.11736	-9.30476	-11.03067	108	1.35098	1.30648	-0.41943
18	0.14739	-8.31536	-10.04127	110	1.32002	1.20579	-0.52012
20	0.18039	-7.43780	-9.16371	112	1.28630	1.09344	-0.63247
22	0.21620	-6.65148	-8.37739	114	1.24999	0.96908	-0.75683
24	0.25461	-5.94119	-7.66710	116	1.21125	0.83232	-0.89359
26	0.29544	-5.29537	-7.02128	118	1.17023	0.68272	-1.04319
28	0.33845	-4.70504	-6.43095	120	1.12714	0.51979	-1.20612
30	0.38344	-4.16308	-5.88899	122	1.08217	0.34295	-1.38296
32	0.43016	-3.66375	-5.38966	124	1.03552	0.15158	-1.57433
34	0.47837	-3.20236	-4.92827	126	0.98741	-0.05502	-1.78093
36	0.52783	-2.77502	-4.50093	128	0.93806	-0.27767	-2.00358
38	0.57830	-2.37848	-4.10439	130	0.88772	-0.51726	-2.24317
40	0.62951	-2.01000	-3.73591	132	0.83660	-0.77482	-2.50073
42	0.68120	-1.66723	-3.39314	134	0.78496	-1.05150	-2.77741
44	0.73314	-1.34816	-3.07407	136	0.73306	-1.34863	-3.07454
46	0.78505	-1.05105	-2.77696	138	0.68113	-1.66772	-3.39363
48	0.83668	-0.77438	-2.50029	140	0.62943	-2.01051	-3.73642
50	0.88780	-0.51684	-2.24275	142	0.57823	-2.37900	-4.10491
52	0.93815	-0.27727	-2.00318	144	0.52777	-2.77555	-4.50146
54	0.98750	-0.05464	-1.78055	146	0.47831	-3.20290	-4.92881
56	1.03561	0.15195	-1.57396	148	0.43010	-3.66431	-5.39022
58	1.08225	0.34330	-1.38261	150	0.38338	-4.16365	-5.88956
60	1.12723	0.52011	-1.20580	152	0.33841	-4.70562	-6.43153
62	1.17032	0.68303	-1.04288	154	0.29540	-5.29597	-7.02188
64	1.21132	0.83261	-0.89330	156	0.25458	-5.94180	-7.66771
66	1.25007	0.96934	-0.75657	158	0.21617	-6.65210	-8.37801
68	1.28638	1.09368	-0.63223	160	0.18037	-7.43842	-9.16433
70	1.32008	1.20601	-0.51990	162	0.14737	-8.31599	-10.04190
72	1.35104	1.30668	-0.41923	164	0.11734	-9.30540	-11.03131
74	1.37911	1.39599	-0.32992	166	0.09046	-10.43555	-12.16146
76	1.40417	1.47421	-0.25170	168	0.06885	-11.74875	-13.47466
78	1.42612	1.54155	-0.18436	170	0.04666	-13.10600	-15.03651
80	1.44485	1.59822	-0.12770	172	0.02998	-15.23097	-16.95688
82	1.46028	1.64436	-0.08155	174	0.01692	-17.71588	-19.44179
84	1.47235	1.68012	-0.04579	176	0.00754	-21.22780	-22.95371
86	1.48101	1.70559	-0.02032	178	0.00189	-27.24246	-28.96837
88	1.48622	1.72084	-0.00507	180	0.00000	-INFINITY	-INFINITY
90	1.48796	1.72591	0				

TABLE A1-43

INTEGRAL EQUATION METHOD
 $\epsilon_{\text{SILICON}} = 1.2500$ (NORMALIZED GROUNDPLANE RADIUS)
 MONOPOLE LENGTH = 0.010000 (WAVELENGTH)
 INFINITELY THIN MONOPOLE RADIUS
 RADIATION RESISTANCE = 0.019916 (DHMS)

ELEVATION ANGLE (DEG)	DIRECTIVITY (NUMERIC)	DIRECTIVITY (DBI)	RELATIVE POWER (DB)	ELEVATION ANGLE (DEG)	DIRECTIVITY (NUMERIC)	DIRECTIVITY (DBI)	RELATIVE POWER (DB)
0	0.00000	-INFINITY	-INFINITY	92.0	1.48493	1.71705	-0.00509
2	0.00189	-27.22511	-28.94725	94.0	1.47973	1.70182	-0.02032
4	0.00757	-21.21054	-22.93268	96.0	1.47110	1.67641	-0.04573
6	0.01699	-17.69875	-19.42089	98.0	1.45907	1.64076	-0.08138
8	0.03010	-15.21403	-16.93617	100.0	1.44370	1.59476	-0.12738
10	0.04684	-12.29390	-15.01604	102.0	1.42505	1.53829	-0.18385
12	0.06711	-11.73235	-13.45449	104.0	1.40319	1.47118	-0.25097
14	0.09079	-10.41949	-12.14163	106.0	1.37824	1.39323	-0.32891
16	0.11777	-9.28973	-11.01187	108.0	1.35028	1.30424	-0.41791
18	0.14789	-8.30075	-10.02289	110.0	1.31945	1.20392	-0.51823
20	0.18098	-7.42366	-9.14580	112.0	1.28587	1.09197	-0.63017
22	0.21688	-6.63785	-8.35999	114.0	1.24970	0.96805	-0.75409
24	0.25538	-5.92810	-7.55024	116.0	1.21109	0.83177	-0.89038
26	0.29529	-5.28285	-7.00500	118.0	1.17022	0.68267	-1.03947
28	0.33938	-4.69313	-6.41527	120.0	1.12727	0.52027	-1.20187
30	0.38443	-4.15179	-5.87394	122.0	1.08243	0.34399	-1.37815
32	0.43121	-3.65312	-5.37526	124.0	1.03591	0.15321	-1.56893
34	0.47947	-3.19240	-4.91454	126.0	0.98792	-0.05279	-1.77493
36	0.52896	-2.76574	-4.48789	128.0	0.93868	-0.27481	-1.99695
38	0.57944	-2.36991	-4.09205	130.0	0.88843	-0.51376	-2.23590
40	0.63065	-2.00213	-3.72427	132.0	0.83740	-0.77066	-2.49280
42	0.68233	-1.66007	-3.38221	134.0	0.78584	-1.04668	-2.76882
44	0.73423	-1.34171	-3.06385	136.0	0.73398	-1.34313	-3.06528
46	0.78609	-1.04530	-2.76744	138.0	0.68210	-1.65155	-3.38369
48	0.83766	-0.76934	-2.49148	140.0	0.63043	-2.00366	-3.72580
50	0.88869	-0.51249	-2.23463	142.0	0.57923	-2.37148	-4.09362
52	0.93894	-0.27360	-1.99574	144.0	0.52877	-2.76736	-4.48951
54	0.98818	-0.05164	-1.77378	146.0	0.47929	-3.19406	-4.91620
56	1.03617	0.15431	-1.56784	148.0	0.43104	-3.65482	-5.37696
58	1.08269	0.34503	-1.37711	150.0	0.38428	-4.15354	-5.87568
60	1.12752	0.52124	-1.20090	152.0	0.33924	-4.69491	-6.41705
62	1.17047	0.68359	-1.03856	154.0	0.29616	-5.28467	-7.00681
64	1.21133	0.83262	-0.88953	156.0	0.25527	-5.92995	-7.65209
66	1.24992	0.96884	-0.75300	158.0	0.21678	-6.63973	-8.36187
68	1.28608	1.09269	-0.62945	160.0	0.18090	-7.42557	-9.14771
70	1.31965	1.20458	-0.51757	162.0	0.14782	-8.30268	-10.02482
72	1.35046	1.30483	-0.41731	164.0	0.11771	-9.29169	-11.01383
74	1.37840	1.39377	-0.32838	166.0	0.09075	-10.42147	-12.14361
76	1.40334	1.47164	-0.25050	168.0	0.06708	-11.73434	-13.45649
78	1.42518	1.53869	-0.18315	170.0	0.04682	-13.29591	-15.01805
80	1.44381	1.59510	-0.12705	172.0	0.03009	-15.21606	-16.93820
82	1.45916	1.64103	-0.08111	174.0	0.01698	-17.70079	-19.42293
84	1.47117	1.67661	-0.04553	176.0	0.00756	-21.21258	-22.93472
86	1.47977	1.70195	-0.02019	178.0	0.00189	-27.22715	-28.94930
88	1.48495	1.71711	-0.00503	180.0	0.00000	-INFINITY	-INFINITY
90	1.48667	1.72214	0				

TABLE A1-44

INTEGRAL EQUATION METHOD
 EPSILON= 1.5000(NORMALIZED GROUNDPLANE RADIUS)
 MONOPOLE LENGTH= 0.010000(WAVELENGTH)
 INFINITELY THIN MONOPOLE RADIUS
 RADIATION RESISTANCE = 0.019940 (OHMS)

ELEVATION ANGLE (DEG)	DIRECTIVITY (NUMERIC)	DIRECTIVITY (DB)	RELATIVE POWER (DB)	ELEVATION ANGLE (DEG)	DIRECTIVITY (NUMERIC)	DIRECTIVITY (DB)	RELATIVE POWER (DB)
0	0.00000	-INFINITY	-INFINITY	92.0	1.48310	1.71171	-0.00511
2.0	0.00191	-27.19992	-28.91674	94.0	1.47792	1.69652	-0.02030
4.0	0.00761	-21.18547	-22.90229	96.0	1.46934	1.67122	-0.04560
6.0	0.01708	-17.67390	-19.39072	98.0	1.45738	1.63573	-0.08109
8.0	0.03027	-15.18947	-16.90629	100.0	1.44210	1.58994	-0.12688
10.0	0.04710	-13.26971	-14.98653	102.0	1.42356	1.53375	-0.18307
12.0	0.06747	-11.70861	-13.42543	104.0	1.40183	1.46697	-0.24985
14.0	0.09128	-10.39628	-12.11310	106.0	1.37702	1.38941	-0.32741
16.0	0.11838	-9.26711	-10.98393	108.0	1.34923	1.30086	-0.41596
18.0	0.14863	-8.27880	-9.99562	110.0	1.31857	1.20103	-0.51579
20.0	0.18187	-7.40243	-9.11925	112.0	1.28518	1.08964	-0.62718
22.0	0.21790	-6.61741	-8.33423	114.0	1.24920	0.96632	-0.75050
24.0	0.25654	-5.90850	-7.62532	116.0	1.21079	0.83068	-0.88614
26.0	0.29757	-5.26414	-6.98036	118.0	1.17011	0.68228	-1.03454
28.0	0.34077	-4.67534	-6.39216	120.0	1.12736	0.52062	-1.19620
30.0	0.38593	-4.13497	-5.85179	122.0	1.08271	0.34512	-1.37170
32.0	0.43278	-3.63728	-5.35410	124.0	1.03637	0.15516	-1.56166
34.0	0.48111	-3.17758	-4.89440	126.0	0.98856	-0.04999	-1.76681
36.0	0.53064	-2.75197	-4.46879	128.0	0.93848	-0.27113	-1.98795
38.0	0.58114	-2.35719	-4.07401	130.0	0.88937	-0.50916	-2.22598
40.0	0.63234	-1.99047	-3.70729	132.0	0.83847	-0.76513	-2.48195
42.0	0.68400	-1.64947	-3.36629	134.0	0.78701	-1.04019	-2.75701
44.0	0.73584	-1.33217	-3.04899	136.0	0.73524	-1.32568	-3.05250
46.0	0.78762	-1.03681	-2.75363	138.0	0.68342	-1.65311	-3.36993
48.0	0.83910	-0.76189	-2.47871	140.0	0.63179	-1.99424	-3.71106
50.0	0.89001	-0.50606	-2.22288	142.0	0.58062	-2.36108	-4.07790
52.0	0.94012	-0.26817	-1.98499	144.0	0.53015	-2.75598	-4.47280
54.0	0.98920	-0.04717	-1.76399	146.0	0.48065	-3.18171	-4.89853
56.0	1.03701	0.15783	-1.55899	148.0	0.43236	-3.64152	-5.35834
58.0	1.08334	0.34764	-1.36918	150.0	0.38554	-4.13931	-5.85613
60.0	1.12797	0.52299	-1.19383	152.0	0.34043	-4.67977	-6.39659
62.0	1.17071	0.68450	-1.03232	154.0	0.29726	-5.26867	-6.98549
64.0	1.21136	0.83275	-0.88407	156.0	0.25626	-5.91311	-7.62993
66.0	1.24975	0.96823	-0.74859	158.0	0.21767	-6.62211	-8.33893
68.0	1.28570	1.09139	-0.62543	160.0	0.18167	-7.40721	-9.12403
70.0	1.31906	1.20263	-0.51419	162.0	0.14847	-8.28364	-10.00046
72.0	1.34968	1.30230	-0.41452	164.0	0.11825	-9.27202	-10.98884
74.0	1.37743	1.39070	-0.32612	166.0	0.09118	-10.40124	-12.11806
76.0	1.40220	1.46809	-0.24873	168.0	0.06740	-11.71362	-13.43044
78.0	1.42387	1.53471	-0.18211	170.0	0.04705	-13.27476	-14.99158
80.0	1.44236	1.59075	-0.12607	172.0	0.03024	-15.19455	-16.91137
82.0	1.45759	1.63637	-0.08045	174.0	0.01706	-17.67900	-19.39582
84.0	1.46950	1.67170	-0.04512	176.0	0.00760	-21.19059	-22.90741
86.0	1.47803	1.69684	-0.01998	178.0	0.00190	-27.20505	-28.92187
88.0	1.48316	1.71187	-0.00495	180.0	0.00000	-INFINITY	-INFINITY
90.0	1.48485	1.71682	0.0				

TABLE A1-45

INTEGRAL EQUATION METHOD
 EPSILON= 1.7500(NORMALIZED GROUNDPLANE RADIUS)
 MONOPOLE LENGTH= 0.010000(WAVELENGTH)
 INFINITELY THIN MONOPOLE RADIUS
 RADIATION RESISTANCE = 0.019997 (OHMS)

ELEVATION ANGLE (DEG)	DIRECTIVITY (NUMERIC)	DIRECTIVITY (DBI)	RELATIVE POWER (DB)	ELEVATION ANGLE (DEG)	DIRECTIVITY (NUMERIC)	DIRECTIVITY (DBI)	RELATIVE POWER (DB)
0	0.00000	-INFINITY	-INFINITY	92.0	1.47889	1.69937	-0.00513
2.0	0.00193	-27.13917	-28.84367	94.0	1.47377	1.68429	-0.02021
4.0	0.00772	-21.12505	-22.82955	96.0	1.46529	1.65923	-0.04527
6.0	0.01732	-17.61402	-19.31852	98.0	1.45349	1.62411	-0.08039
8.0	0.03069	-15.13034	-16.83484	100.0	1.43841	1.57883	-0.12567
10.0	0.04774	-13.21154	-14.91604	102.0	1.42012	1.52327	-0.18123
12.0	0.06837	-11.65159	-13.35609	104.0	1.39870	1.45725	-0.24725
14.0	0.09246	-10.34060	-12.04510	106.0	1.37423	1.38059	-0.32391
16.0	0.11987	-9.21295	-10.91745	108.0	1.34681	1.29305	-0.41145
18.0	0.15044	-8.22632	-9.93082	110.0	1.31655	1.19437	-0.51013
20.0	0.18400	-7.35180	-9.05630	112.0	1.28358	1.08424	-0.62026
22.0	0.22036	-6.56876	-8.27326	114.0	1.24805	0.96230	-0.74220
24.0	0.25930	-5.86195	-7.56645	116.0	1.21009	0.82817	-0.87633
26.0	0.30062	-5.21981	-6.92431	118.0	1.16987	0.68139	-1.02311
28.0	0.34409	-4.63333	-6.33783	120.0	1.12757	0.52145	-1.18305
30.0	0.38946	-4.05336	-5.79986	122.0	1.08337	0.34778	-1.35672
32.0	0.43650	-3.60014	-5.30464	124.0	1.03747	0.15974	-1.54476
34.0	0.48496	-3.14296	-4.84746	126.0	0.99006	-0.04338	-1.74788
36.0	0.53458	-2.71990	-4.42440	128.0	0.94137	-0.26242	-1.96692
38.0	0.58510	-2.32768	-4.03218	130.0	0.89161	-0.49827	-2.20277
40.0	0.63628	-1.96355	-3.66805	132.0	0.84101	-0.75199	-2.45649
42.0	0.68784	-1.62512	-3.32962	134.0	0.78982	-1.02474	-2.72924
44.0	0.73954	-1.31037	-3.01487	136.0	0.73827	-1.31787	-3.02237
46.0	0.79113	-1.01753	-2.72203	138.0	0.68661	-1.63292	-3.33742
48.0	0.84235	-0.74508	-2.44958	140.0	0.63509	-1.97162	-3.67612
50.0	0.89296	-0.49167	-2.19617	142.0	0.58398	-2.33604	-4.04054
52.0	0.94273	-0.25613	-1.96063	144.0	0.53352	-2.72851	-4.43301
54.0	0.99142	-0.03741	-1.74191	146.0	0.48397	-3.15183	-4.85633
56.0	1.03882	0.16540	-1.53910	148.0	0.43559	-3.60926	-5.31376
58.0	1.08470	0.35311	-1.35139	150.0	0.38862	-4.10472	-5.80922
60.0	1.12887	0.52645	-1.17805	152.0	0.34333	-4.64291	-6.34741
62.0	1.17113	0.68607	-1.01843	154.0	0.29994	-5.22960	-6.93410
64.0	1.21130	0.83252	-0.87198	156.0	0.25871	-5.87194	-7.57644
66.0	1.24920	0.96632	-0.73818	158.0	0.21984	-6.57893	-8.28343
68.0	1.28467	1.08792	-0.61658	160.0	0.18356	-7.36215	-9.06655
70.0	1.31757	1.19772	-0.50678	162.0	0.15008	-8.23683	-9.94133
72.0	1.34774	1.29607	-0.40843	164.0	0.11957	-9.22360	-10.92810
74.0	1.37508	1.38327	-0.32123	166.0	0.09223	-10.35137	-12.05587
76.0	1.39946	1.45960	-0.24490	168.0	0.06820	-11.66247	-13.36697
78.0	1.42078	1.52528	-0.17922	170.0	0.04762	-13.22252	-14.92702
80.0	1.43897	1.58051	-0.12399	172.0	0.03061	-15.14140	-16.84590
82.0	1.45394	1.62545	-0.07905	174.0	0.01728	-17.62513	-19.32963
84.0	1.46563	1.66024	-0.04426	176.0	0.00770	-22.84071	-22.84071
86.0	1.47400	1.68496	-0.01954	178.0	0.00193	-27.15036	-28.85486
88.0	1.47901	1.69970	-0.00480	180.0	0.00000	-INFINITY	-INFINITY
90.0	1.48064	1.70450	0.0				

TABLE A1-46

INTEGRAL EQUATION METHOD
 EPSILON = 2.000000 (NORMALIZED GROUNDPLANE RADIUS)
 MONOPOLE LENGTH = 0.010000 (WAVELENGTH)
 INFINITELY THIN MONOPOLE RADIUS
 RADIATION RESISTANCE = 0.020129 (OHMS)

ELEVATION ANGLE (DEG)	DIRECTIVITY (NUMERIC)	DIRECTIVITY (DBI)	RELATIVE POWER (DB)	ELEVATION ANGLE (DEG)	DIRECTIVITY (NUMERIC)	DIRECTIVITY (DBI)	RELATIVE POWER (DB)
0	0.00000	-INFINITY	-INFINITY	92.0	1.46914	1.67062	-0.00514
2	0.00200	-26.99127	-28.66703	94.0	1.46414	1.65584	-0.01992
4	0.00798	-20.97800	-22.65376	96.0	1.45591	1.63135	-0.04441
6	0.01791	-17.46837	-19.14413	98.0	1.44448	1.59711	-0.07855
8	0.03172	-14.98665	-16.66241	100.0	1.42988	1.55299	-0.12277
10	0.04931	-13.07033	-14.74609	102.0	1.41217	1.49888	-0.17688
12	0.07058	-11.51337	-13.18913	104.0	1.39143	1.43462	-0.24114
14	0.09537	-10.20584	-11.88160	106.0	1.36773	1.36000	-0.31576
16	0.12353	-9.08212	-10.75788	108.0	1.34116	1.27480	-0.40096
18	0.15489	-8.09983	-9.77559	110.0	1.31182	1.17875	-0.49701
20	0.18923	-7.23003	-8.90579	112.0	1.27983	1.07154	-0.60422
22	0.22636	-6.45206	-8.12782	114.0	1.24532	0.95282	-0.72294
24	0.26603	-5.75063	-7.42639	116.0	1.20842	0.82218	-0.85358
26	0.30803	-5.11413	-6.78989	118.0	1.16928	0.67918	-0.99658
28	0.35209	-4.53352	-6.20928	120.0	1.12805	0.52330	-1.15246
30	0.39796	-4.00160	-5.67736	122.0	1.08492	0.35396	-1.32180
32	0.44539	-3.51256	-5.18832	124.0	1.04004	0.17051	-1.50525
34	0.49412	-3.06167	-4.73743	126.0	0.99362	-0.02779	-1.70355
36	0.54388	-2.64495	-4.32071	128.0	0.94585	-0.24176	-1.91752
38	0.59442	-2.25910	-3.93486	130.0	0.89695	-0.47233	-2.14809
40	0.64546	-1.90130	-3.57706	132.0	0.84712	-0.72057	-2.39633
42	0.69676	-1.56917	-3.24493	134.0	0.79659	-0.98768	-2.66344
44	0.74806	-1.26062	-2.93638	136.0	0.74559	-1.27501	-2.95077
46	0.79912	-0.97387	-2.64963	138.0	0.69436	-1.58413	-3.25989
48	0.84970	-0.70735	-2.38311	140.0	0.64316	-1.91682	-3.59258
50	0.89956	-0.45971	-2.13547	142.0	0.59222	-2.27515	-3.95091
52	0.94847	-0.22975	-1.90551	144.0	0.54181	-2.66153	-4.33729
54	0.99623	-0.01639	-1.69215	146.0	0.49218	-3.07875	-4.75451
56	1.04263	0.18128	-1.49448	148.0	0.44360	-3.53013	-5.20589
58	1.08745	0.36411	-1.31165	150.0	0.39631	-4.01963	-5.69539
60	1.13053	0.53282	-1.14294	152.0	0.35059	-4.51999	-6.22775
62	1.17167	0.68807	-0.98769	154.0	0.30669	-5.13302	-6.80878
64	1.21072	0.83044	-0.84532	156.0	0.26486	-5.76991	-7.44567
66	1.24751	0.96043	-0.71533	158.0	0.22534	-6.47171	-8.14747
68	1.28189	1.07852	-0.59724	160.0	0.18836	-7.25002	-8.92578
70	1.31374	1.18509	-0.49067	162.0	0.15417	-8.12013	-9.79589
72	1.34292	1.28050	-0.39526	164.0	0.12295	-9.10270	-10.77846
74	1.36933	1.36507	-0.31059	166.0	0.09491	-10.22667	-11.90243
76	1.39285	1.43905	-0.23671	168.0	0.07024	-11.53441	-13.21017
78	1.41341	1.50268	-0.17308	170.0	0.04907	-13.09156	-14.76732
80	1.43092	1.55616	-0.11950	172.0	0.03156	-15.00804	-16.68380
82	1.44532	1.59964	-0.07612	174.0	0.01782	-17.48988	-19.16564
84	1.45655	1.63325	-0.04251	176.0	0.00794	-20.99959	-22.67535
86	1.46457	1.65710	-0.01866	178.0	0.00199	-27.01291	-28.68867
88	1.46935	1.67126	-0.00450	180	0.00000	-INFINITY	-INFINITY
90	1.47088	1.67576	0				

TABLE AI-47

INTEGRAL EQUATION METHOD
 EPSILON= 2.2500(NORMALIZED GROUNDPLANE RADIUS)
 MONOPOLE LENGTH= 0.010000(WAVELENGTH)
 INFINITELY THIN MONOPOLE RADIUS
 RADIATION RESISTANCE = 0.020430 (DHMS)

ELEVATION ANGLE (DEG)	DIRECTIVITY (NUMERIC)	DIRECTIVITY (DBI)	RELATIVE POWER (DB)	ELEVATION ANGLE (DEG)	DIRECTIVITY (NUMERIC)	DIRECTIVITY (DBI)	RELATIVE POWER (DB)
0	0.00000	-INFINITY	-INFINITY	92	1.44757	1.60641	-0.00507
2	0.00216	-26.65013	-28.26161	94	1.44288	1.59230	-0.01918
4	0.00863	-20.63892	-22.25040	96	1.43519	1.56910	-0.04237
6	0.01935	-17.13271	-18.74418	98	1.42454	1.53675	-0.07472
8	0.03423	-14.55572	-16.26719	100	1.41096	1.49516	-0.11631
10	0.05314	-12.74540	-14.35688	102	1.39450	1.44420	-0.16728
12	0.07593	-11.19568	-12.80715	104	1.37522	1.38371	-0.22776
14	0.10241	-9.89654	-11.50802	106	1.35317	1.31352	-0.29796
16	0.13236	-8.78229	-10.39376	108	1.32843	1.23339	-0.37809
18	0.16556	-7.81047	-9.42194	110	1.30109	1.14306	-0.46841
20	0.20174	-6.95205	-8.56352	112	1.27123	1.04225	-0.56923
22	0.24064	-6.18627	-7.79774	114	1.23896	0.93058	-0.68089
24	0.28199	-5.49774	-7.10921	116	1.20439	0.80768	-0.80380
26	0.32548	-4.87475	-6.48622	118	1.16764	0.67308	-0.93840
28	0.37084	-4.30813	-5.91961	120	1.12882	0.52626	-1.08522
30	0.41777	-3.79060	-5.40208	122	1.08809	0.36664	-1.24484
32	0.46599	-3.31625	-4.92772	124	1.04557	0.19355	-1.41793
34	0.51520	-2.88021	-4.49168	126	1.00144	0.00624	-1.60524
36	0.56514	-2.47842	-4.08990	128	0.95584	-0.19615	-1.80763
38	0.61553	-2.10749	-3.71896	130	0.90895	-0.41458	-2.02606
40	0.66612	-1.76450	-3.37597	132	0.86096	-0.65015	-2.26163
42	0.71664	-1.44697	-3.05845	134	0.81206	-0.90411	-2.51559
44	0.76687	-1.15276	-2.76423	136	0.76245	-1.17787	-2.78935
46	0.81658	-0.88000	-2.49147	138	0.71235	-1.47306	-3.08454
48	0.86555	-0.62706	-2.23853	140	0.66198	-1.79154	-3.40301
50	0.91358	-0.39253	-2.00401	142	0.61158	-2.13545	-3.74692
52	0.96047	-0.17516	-1.78663	144	0.56140	-2.50727	-4.11874
54	1.00604	0.02615	-1.58532	146	0.51169	-2.90990	-4.52137
56	1.05012	0.21238	-1.39909	148	0.46273	-3.34676	-4.95823
58	1.09254	0.38437	-1.22710	150	0.41477	-3.82188	-5.43336
60	1.13316	0.54289	-1.06858	152	0.36812	-4.34014	-5.95162
62	1.17182	0.68860	-0.92287	154	0.32304	-4.90744	-6.51892
64	1.20840	0.82209	-0.78938	156	0.27983	-5.53108	-7.14255
66	1.24276	0.94388	-0.66759	158	0.23877	-6.22020	-7.83167
68	1.27480	1.05443	-0.55704	160	0.20015	-6.98653	-8.59800
70	1.30441	1.15413	-0.45734	162	0.16423	-7.84545	-9.45692
72	1.33148	1.24334	-0.36813	164	0.13129	-8.81771	-10.42919
74	1.35593	1.32236	-0.28912	166	0.10157	-9.93236	-11.54384
76	1.37767	1.39144	-0.22003	168	0.07530	-11.23184	-12.84332
78	1.39663	1.45082	-0.16066	170	0.05270	-12.78186	-14.39334
80	1.41276	1.50067	-0.11080	172	0.03394	-14.69242	-16.30389
82	1.42599	1.54116	-0.07031	174	0.01919	-17.16959	-18.78107
84	1.43628	1.57241	-0.03807	176	0.00856	-20.67594	-22.28742
86	1.44361	1.59450	-0.01698	178	0.00214	-26.68723	-28.29871
88	1.44794	1.60751	-0.00397	180	0.00000	-INFINITY	-INFINITY
90	1.44926	1.61147	0				

TABLE A1-48

INTEGRAL EQUATION METHOD
 EPSILDN= 2.5000(NORMALIZED GROUNDPLANE RADIUS)
 MONOPDLE LENGTH= 0.010000(WAVELENGTH)
 INFINITELY THIN MONOPDLE RADIUS
 RADIATION RESISTANCE = 0.021093 (DHMS)

ELEVATION ANGLE (DEG)	DIRECTIVITY (NUMERIC)	DIRECTIVITY (DBI)	RELATIVE POWER (0B)	ELEVATION ANGLE (DEG)	DIRECTIVITY (NUMERIC)	DIRECTIVITY (DBI)	RELATIVE POWER (0B)
0	0.00000	-INFINITY	-INFINITY	92.0	1.40210	1.46780	-0.00481
2.0	0.00255	-25.93310	-27.40572	94.0	1.39803	1.45517	-0.01745
4.0	0.01017	-19.92621	-21.39883	96.0	1.39145	1.43467	-0.03795
6.0	0.02277	-16.42717	-17.89978	98.0	1.38237	1.40626	-0.06636
8.0	0.04018	-13.96013	-15.43274	100.0	1.37084	1.36986	-0.10275
10.0	0.06219	-12.06246	-13.53507	102.0	1.35687	1.32538	-0.14724
12.0	0.08855	-10.52797	-12.00059	104.0	1.34050	1.27268	-0.19993
14.0	0.11894	-9.24654	-10.71916	106.0	1.32179	1.21162	-0.26100
16.0	0.15303	-8.15231	-9.62492	108.0	1.30077	1.14199	-0.33062
18.0	0.19043	-7.20265	-8.67527	110.0	1.27749	1.06357	-0.40904
20.0	0.23076	-6.36837	-7.84098	112.0	1.25201	0.97609	-0.49653
22.0	0.27362	-5.62849	-7.10110	114.0	1.22439	0.87921	-0.59340
24.0	0.31861	-4.96742	-6.44004	116.0	1.19469	0.77257	-0.70005
26.0	0.36532	-4.37323	-5.84584	118.0	1.16238	0.65571	-0.81690
28.0	0.41338	-3.83652	-5.20914	120.0	1.12931	0.52813	-0.94449
30.0	0.46240	-3.34978	-4.82240	122.0	1.09376	0.38922	-1.08340
32.0	0.51205	-2.90686	-4.37948	124.0	1.05640	0.23830	-1.23432
34.0	0.56200	-2.50267	-3.97528	126.0	1.01732	0.07457	-1.39804
36.0	0.61194	-2.13293	-3.60554	128.0	0.97659	-0.10287	-1.57548
38.0	0.66161	-1.79400	-3.26662	130.0	0.93432	-0.29506	-1.76767
40.0	0.71076	-1.48278	-2.95540	132.0	0.89060	-0.50318	-1.97580
42.0	0.75917	-1.19659	-2.66921	134.0	0.84555	-0.72860	-2.20122
44.0	0.80666	-0.93310	-2.40571	136.0	0.79931	-0.97286	-2.44548
46.0	0.85305	-0.69027	-2.16289	138.0	0.75202	-1.23773	-2.71035
48.0	0.89818	-0.46634	-1.93896	140.0	0.70384	-1.52524	-2.99785
50.0	0.94194	-0.25376	-1.73238	142.0	0.65498	-1.83770	-3.31031
52.0	0.98420	-0.06916	-1.54178	144.0	0.60565	-2.17780	-3.65042
54.0	1.02486	0.10665	-1.36597	146.0	0.55608	-2.54865	-4.02127
56.0	1.06383	0.26870	-1.20391	148.0	0.50654	-2.95388	-4.42650
58.0	1.10101	0.41793	-1.05469	150.0	0.45732	-3.39777	-4.87038
60.0	1.13635	0.55511	-0.91751	152.0	0.40875	-3.88540	-5.35801
62.0	1.16975	0.68094	-0.79167	154.0	0.36117	-4.42293	-5.89554
64.0	1.20117	0.79603	-0.67659	156.0	0.31493	-5.01787	-6.49049
66.0	1.23052	0.90089	-0.57173	158.0	0.27042	-5.67962	-7.15223
68.0	1.25776	0.99597	-0.47664	160.0	0.22803	-6.42011	-7.89273
70.0	1.28282	1.08165	-0.39096	162.0	0.18815	-7.25494	-8.72756
72.0	1.30565	1.15827	-0.31435	164.0	0.15118	-8.20507	-9.67769
74.0	1.32620	1.22608	-0.24653	166.0	0.11750	-9.29973	-10.77234
76.0	1.34442	1.28534	-0.18728	168.0	0.08747	-10.58152	-12.05413
78.0	1.36026	1.33622	-0.13639	170.0	0.06143	-12.11630	-13.58892
80.0	1.37369	1.37889	-0.09372	172.0	0.03968	-14.01421	-15.48683
82.0	1.38468	1.41348	-0.05913	174.0	0.02248	-16.48144	-17.95406
84.0	1.39318	1.44008	-0.03253	176.0	0.01004	-19.98062	-21.45323
86.0	1.39919	1.45877	-0.01384	178.0	0.00252	-25.98759	-27.46020
88.0	1.40269	1.46961	-0.00301	180.0	0.00000	-INFINITY	-INFINITY
90.0	1.40366	1.47262	0.0				

TABLE A1-49

INTEGRAL EQUATION METHOD
 EPSILON= 2.7500(NORMALIZED GROUNDPLANE RADIUS)
 MONOPOLE LENGTH= 0.010000(WAVELENGTH)
 INFINITELY THIN MONOPOLE RADIUS
 RADIATION RESISTANCE = 0.022546 (OHMS)

ELEVATION ANGLE (DEG)	DIRECTIVITY (NUMERIC)	DIRECTIVITY (DBI)	RELATIVE POWER (DB)	ELEVATION ANGLE (DEG)	DIRECTIVITY (NUMERIC)	DIRECTIVITY (DBI)	RELATIVE POWER (DB)
0	0.00000	-INFINITY	-INFINITY	92.0	1.30845	1.16759	-5.93443
2.0	5.13099	7.10202	0.0	94.0	1.30203	1.14622	-5.95580
4.0	1.25506	0.98666	-6.11536	96.0	1.29399	1.11932	-5.98269
6.0	0.54526	-2.63399	-9.73601	98.0	1.28436	1.08687	-6.01514
8.0	0.29948	-5.23632	-12.33834	100.0	1.27316	1.04884	-6.05318
10.0	0.18691	-7.28357	-14.38559	102.0	1.26043	1.00517	-6.09684
12.0	0.12640	-8.98260	-16.08461	104.0	1.24618	0.95582	-6.14619
14.0	0.09028	-10.44429	-17.54631	106.0	1.23047	0.90071	-6.20131
16.0	0.06706	-11.73542	-18.83743	108.0	1.21331	0.83973	-6.26229
18.0	0.05129	-12.89964	-20.00165	110.0	1.19474	0.77274	-6.32928
20.0	0.04011	-13.96746	-21.06947	112.0	1.17478	0.69955	-6.40247
22.0	0.03191	-14.96141	-22.06342	114.0	1.15343	0.61993	-6.48209
24.0	0.02571	-15.89903	-23.00104	116.0	1.13072	0.53356	-6.56846
26.0	0.02092	-16.79472	-23.89674	118.0	1.10664	0.44005	-6.66197
28.0	0.01714	-17.66100	-24.76302	120.0	1.08116	0.33892	-6.76310
30.0	0.01409	-18.50946	-25.61147	122.0	1.05428	0.22958	-6.87244
32.0	0.01161	-19.35158	-26.45359	124.0	1.02596	0.11130	-6.99072
34.0	0.00955	-20.19963	-27.30164	126.0	0.99615	-0.01677	-7.11878
36.0	0.00782	-21.06777	-28.16979	128.0	0.96480	-0.15564	-7.25766
38.0	0.00635	-21.97367	-29.07569	130.0	0.93186	-0.30651	-7.40853
40.0	0.00508	-22.94121	-30.04322	132.0	0.89727	-0.47076	-7.57277
42.0	0.00398	-24.00548	-31.10750	134.0	0.86100	-0.64997	-7.75199
44.0	0.00300	-25.22343	-32.32545	136.0	0.82300	-0.84599	-7.94800
46.0	0.00214	-26.69976	-33.80178	138.0	0.78327	-1.06088	-8.16290
48.0	0.00136	-28.66722	-35.76924	140.0	0.74182	-1.29704	-8.39906
50.0	0.00065	-31.86507	-38.96709	142.0	0.69869	-1.55716	-8.65918
52.0	1.07933	0.33153	-6.77048	144.0	0.65398	-1.84433	-8.94635
54.0	1.10870	0.44816	-6.65386	146.0	0.60784	-2.16208	-9.26410
56.0	1.13582	0.55309	-6.54892	148.0	0.56047	-2.51447	-9.61649
58.0	1.16077	0.64746	-6.45456	150.0	0.51213	-2.90621	-10.00822
60.0	1.18365	0.73222	-6.36979	152.0	0.46315	-3.34281	-10.44483
62.0	1.20454	0.80821	-6.29381	154.0	0.41392	-3.83085	-10.93286
64.0	1.22352	0.87612	-6.22590	156.0	0.36490	-4.37825	-11.48026
66.0	1.24066	0.93653	-6.16548	158.0	0.31661	-4.99478	-12.09679
68.0	1.25601	0.98995	-6.11207	160.0	0.26960	-5.69274	-12.79476
70.0	1.26962	1.03674	-6.06527	162.0	0.22449	-6.48807	-13.59009
72.0	1.28151	1.07724	-6.02478	164.0	0.18189	-7.40203	-14.50404
74.0	1.29172	1.11168	-5.99034	166.0	0.14243	-8.46411	-15.56613
76.0	1.30024	1.14024	-5.96177	168.0	0.10673	-9.71718	-16.81920
78.0	1.30710	1.16308	-5.93893	170.0	0.07538	-11.22731	-18.32933
80.0	1.31229	1.18029	-5.92173	172.0	0.04892	-13.10481	-20.20682
82.0	1.31581	1.19193	-5.91009	174.0	0.02782	-15.55600	-22.65802
84.0	1.31766	1.19805	-5.90397	176.0	0.01246	-19.04365	-26.14567
86.0	1.31785	1.19867	-5.90335	178.0	0.00313	-25.04367	-32.14568
88.0	1.31638	1.19780	-5.90821	180.0	0.00000	-INFINITY	-INFINITY
90.0	1.31324	1.18344	-5.91857				

APPENDIX A2. METHOD OF MOMENTS

		Page
Tables A2-1 - A2-57;	$0 < ka \leq 14.0$, $h/\lambda = 0.25$, $b/\lambda = 10^{-6}$, $N=1$	54
Tables A2-58 - A2-66;	Experimental monopole antennas, $h/\lambda \approx 0.25$, $b = 0.25$ in., $N=4$	111

TABLE A2-1

ELEVATION= 0.4500(NORMALIZED GROUNDPLANE RADIUS)
 MONOPOLE LENGTH= 0.250000(WAVELENGTH)
 MONOPOLE RADIUS= 0.1000E-05(WAVELENGTH)
 NUMBER OF MONOPOLE SEGMENTS= 1
 NUMBER OF DISK SEGMENTS= 3
 RADIATION RESISTANCE DETERMINED BY PATTERN= 0.194895E+02 OHMS

ELEVATION ANGLE (DEG)	DIRECTIVITY (NUMERIC)	DIRECTIVITY (DBI)	RELATIVE POWER (DB)	ELEVATION ANGLE (DEG)	DIRECTIVITY (NUMERIC)	DIRECTIVITY (DBI)	RELATIVE POWER (DB)
0	0.00000	-INFINITY	-INFINITY	92.0	1.53717	1.86723	-0.00598
2.0	0.00164	-27.84266	-29.71588	94.0	1.53083	1.84927	-0.02395
4.0	0.00657	-21.82525	-23.69846	96.0	1.52030	1.81930	-0.03392
6.0	0.01476	-18.30874	-20.18196	98.0	1.50566	1.77727	-0.05994
8.0	0.02620	-15.81745	-17.69066	100.0	1.48700	1.72312	-0.15010
10.0	0.04084	-13.88892	-15.76213	102.0	1.46445	1.65675	-0.21647
12.0	0.05865	-12.31719	-14.19040	104.0	1.43815	1.57805	-0.29517
14.0	0.07957	-10.99243	-12.86564	106.0	1.40828	1.48688	-0.38634
16.0	0.10354	-9.84909	-11.72230	108.0	1.37502	1.38307	-0.49014
18.0	0.13047	-8.84494	-10.71815	110.0	1.33858	1.26644	-0.60677
20.0	0.16028	-7.95115	-9.82437	112.0	1.29920	1.13675	-0.73646
22.0	0.19288	-7.14721	-8.92042	114.0	1.25711	0.99374	-0.87947
24.0	0.22814	-6.41797	-8.29119	116.0	1.21258	0.83712	-1.03610
26.0	0.26595	-5.75199	-7.62521	118.0	1.16587	0.66652	-1.20669
28.0	0.30617	-5.14038	-7.01360	120.0	1.11726	0.48156	-1.39166
30.0	0.34865	-4.57613	-6.44934	122.0	1.06703	0.28177	-1.59144
32.0	0.39322	-4.05361	-5.92682	124.0	1.01546	0.06665	-1.80657
34.0	0.43972	-3.56823	-5.44145	126.0	0.96285	-0.16441	-2.03763
36.0	0.48795	-3.11624	-4.98946	128.0	0.90947	-0.41210	-2.28531
38.0	0.53771	-2.69451	-4.56772	130.0	0.85562	-0.67718	-2.55040
40.0	0.58879	-2.30040	-4.17361	132.0	0.80157	-0.96057	-2.83378
42.0	0.64096	-1.93171	-3.80492	134.0	0.74760	-1.26329	-3.13651
44.0	0.69398	-1.58654	-3.45975	136.0	0.69398	-1.58655	-3.45976
46.0	0.74760	-1.26329	-3.13650	138.0	0.64096	-1.93171	-3.80493
48.0	0.80157	-0.96056	-2.83378	140.0	0.58879	-2.30041	-4.17362
50.0	0.85562	-0.67718	-2.55039	142.0	0.53771	-2.69451	-4.56773
52.0	0.90948	-0.41209	-2.28531	144.0	0.48795	-3.11625	-4.98946
54.0	0.96285	-0.16441	-2.03762	146.0	0.43972	-3.56824	-5.44145
56.0	1.01547	0.06665	-1.80656	148.0	0.39322	-4.05361	-5.92683
58.0	1.06703	0.28178	-1.59144	150.0	0.34865	-4.57614	-6.44935
60.0	1.11727	0.48156	-1.39165	152.0	0.30617	-5.14039	-7.01361
62.0	1.16588	0.66652	-1.20669	154.0	0.26595	-5.75200	-7.62522
64.0	1.21258	0.83712	-1.03609	156.0	0.22814	-6.41798	-8.29120
66.0	1.25711	0.99375	-0.87947	158.0	0.19288	-7.14722	-9.02043
68.0	1.29920	1.13676	-0.73646	160.0	0.16028	-7.95116	-9.82438
70.0	1.33858	1.26644	-0.60677	162.0	0.13047	-8.84495	-10.71816
72.0	1.37502	1.38308	-0.49014	164.0	0.10354	-9.84910	-11.72231
74.0	1.40828	1.48688	-0.38633	166.0	0.07957	-10.99243	-12.86565
76.0	1.43815	1.57805	-0.29516	168.0	0.05865	-12.31720	-14.19040
78.0	1.46445	1.65675	-0.21646	170.0	0.04084	-13.88892	-15.76214
80.0	1.48700	1.72312	-0.15010	172.0	0.02620	-15.81746	-17.69067
82.0	1.50566	1.77727	-0.09594	174.0	0.01476	-18.30875	-20.18197
84.0	1.52030	1.81930	-0.05392	176.0	0.00657	-21.82526	-23.69847
86.0	1.53083	1.84927	-0.02395	178.0	0.00164	-27.84267	-29.71589
88.0	1.53717	1.86723	-0.00598	180	0.00000	-INFINITY	-INFINITY
90.0	1.53929	1.87321	0.00000				

TABLE A2-2

EPSLN= 0.5000(NORMALIZED GROUNDPLANE RADIUS)
 MONOPOLE LENGTH= 0.250000(WAVELENGTH)
 MONOPOLE RADIUS= 0.10000E-05(WAVELENGTH)
 NUMBER OF MONOPOLE SEGMENTS= 1
 NUMBER OF DISK SEGMENTS= 7
 RADIATION RESISTANCE DETERMINED BY PATTERN= 0.196224E+02 OHMS

ELEVATION ANGLE (DEG)	DIRECTIVITY (NUMERIC)	DIRECTIVITY (DB)	RELATIVE POWER (DB)	ELEVATION ANGLE (DEG)	DIRECTIVITY (NUMERIC)	DIRECTIVITY (DB)	RELATIVE POWER (DB)
0	0.00000	-INFINITY	-INFINITY	92.0	1.52682	1.83789	-0.00581
2.0	0.00169	-27.72040	-29.56410	94.0	1.52071	1.82047	-0.02323
4.0	0.00676	-21.70354	-23.54724	96.0	1.51057	1.79141	-0.05229
6.0	0.01518	-18.18796	-20.03166	98.0	1.49646	1.75065	-0.09304
8.0	0.02693	-15.69795	-17.54165	100.0	1.47847	1.69812	-0.14357
10.0	0.04197	-13.77107	-15.61476	102.0	1.45671	1.63373	-0.20997
12.0	0.06024	-12.20133	-14.04503	104.0	1.43131	1.55733	-0.28636
14.0	0.08168	-10.87890	-12.72260	106.0	1.40243	1.46880	-0.37490
16.0	0.10621	-9.73822	-11.58192	108.0	1.37023	1.36794	-0.47576
18.0	0.13375	-8.73704	-10.58074	110.0	1.33492	1.25455	-0.58915
20.0	0.16419	-7.84653	-9.69023	112.0	1.29670	1.12839	-0.71531
22.0	0.19742	-7.04614	-8.89984	114.0	1.25579	0.98918	-0.84552
24.0	0.23331	-6.32073	-8.16442	116.0	1.21244	0.83659	-1.00711
26.0	0.27172	-5.65882	-7.50251	118.0	1.16688	0.67027	-1.17343
28.0	0.31250	-5.05150	-6.89520	120.0	1.11938	0.48978	-1.35392
30.0	0.35549	-4.49175	-6.33545	122.0	1.07020	0.29466	-1.54904
32.0	0.40051	-3.97391	-5.81761	124.0	1.01961	0.08436	-1.75934
34.0	0.44736	-3.49339	-5.33708	126.0	0.96789	-0.14174	-1.98544
36.0	0.49586	-3.04638	-4.89008	128.0	0.91530	-0.38434	-2.22804
38.0	0.54579	-2.62975	-4.47344	130.0	0.86213	-0.64426	-2.48795
40.0	0.59692	-2.24083	-4.08453	132.0	0.80865	-0.92241	-2.76610
42.0	0.64903	-1.87738	-3.72108	134.0	0.75512	-1.21985	-3.06355
44.0	0.70186	-1.53751	-3.38120	136.0	0.70181	-1.53781	-3.38151
46.0	0.75517	-1.21955	-3.06325	138.0	0.64898	-1.87770	-3.72140
48.0	0.80870	-0.92212	-2.76581	140.0	0.59688	-2.24115	-4.08485
50.0	0.86219	-0.64398	-2.48767	142.0	0.54575	-2.63008	-4.47378
52.0	0.91536	-0.38407	-2.22777	144.0	0.49582	-3.04672	-4.89042
54.0	0.96795	-0.14148	-1.98518	146.0	0.44733	-3.49373	-5.33743
56.0	1.01967	0.08461	-1.75909	148.0	0.40047	-3.97427	-5.81796
58.0	1.07026	0.29489	-1.54880	150.0	0.35546	-4.49211	-6.33581
60.0	1.11944	0.49000	-1.35370	152.0	0.31247	-5.05187	-6.89557
62.0	1.16694	0.67047	-1.17322	154.0	0.27169	-5.65919	-7.50288
64.0	1.21249	0.83679	-1.00691	156.0	0.23329	-6.32110	-8.16480
66.0	1.25585	0.98936	-0.85434	158.0	0.19740	-7.04652	-8.89022
68.0	1.29675	1.12856	-0.71514	160.0	0.16418	-7.84691	-9.69061
70.0	1.33497	1.25471	-0.58899	162.0	0.13374	-8.73861	-10.58113
72.0	1.37028	1.36808	-0.47562	164.0	0.10620	-9.73861	-11.58231
74.0	1.40247	1.46892	-0.37477	166.0	0.08167	-10.87929	-12.72299
76.0	1.43135	1.55744	-0.28625	168.0	0.06023	-12.20173	-14.04542
78.0	1.45674	1.63382	-0.20988	170.0	0.04196	-13.77146	-15.61516
80.0	1.47850	1.69820	-0.14549	172.0	0.02693	-15.69835	-17.54205
82.0	1.49648	1.75072	-0.09298	174.0	0.01518	-18.18836	-20.03206
84.0	1.51059	1.79146	-0.05224	176.0	0.00675	-21.70394	-23.54764
86.0	1.52072	1.82050	-0.02319	178.0	0.00169	-27.72080	-29.56450
88.0	1.52683	1.83791	-0.00579	180.0	0.00000	-INFINITY	-INFINITY
90.0	1.52887	1.84370	0.00000				

TABLE A2-3

EPSLN= 0.750(NORMALIZED GROUNDPLANE RADIUS)
 MONOPOLE LENGTH= 0.25000(WAVELENGTH)
 MONOPOLE RADIUS= 0.1000E-05(WAVELENGTH)
 NUMBER OF MONOPOLE SEGMENTS= 1
 NUMBER OF DISK SEGMENTS= 16
 RADIATION RESISTANCE DETERMINED BY PATTERN= 0.198576E+02 OHMS

ELEVATION ANGLE (DEG)	DIRECTIVITY (NUMERIC)	DIRECTIVITY (DBI)	RELATIVE POWER (DB)	ELEVATION ANGLE (DEG)	DIRECTIVITY (NUMERIC)	DIRECTIVITY (DBI)	RELATIVE POWER (DB)
0	0.00000	-INFINITY	-INFINITY	92.0	1.50882	1.78638	-0.00536
2.0	0.00177	-27.50945	-29.30139	94.0	1.50309	1.76985	-0.02208
4.0	0.00709	-21.49354	-23.28548	96.0	1.49359	1.74232	-0.04961
6.0	0.01592	-19.77953	-19.77147	98.0	1.48038	1.70372	-0.08821
8.0	0.02824	-15.49172	-17.28365	100.0	1.46331	1.65397	-0.13797
10.0	0.04398	-13.56763	-15.35957	102.0	1.44310	1.59295	-0.19898
12.0	0.06308	-12.00129	-13.79323	104.0	1.41923	1.52053	-0.27141
14.0	0.08545	-10.68284	-12.47477	106.0	1.39204	1.43652	-0.35541
16.0	0.11100	-9.54670	-11.33863	108.0	1.36168	1.34074	-0.45119
18.0	0.13962	-8.55059	-10.34253	110.0	1.32830	1.23295	-0.55899
20.0	0.17117	-7.66567	-9.45760	112.0	1.29207	1.11287	-0.67906
22.0	0.20552	-6.87135	-8.66329	114.0	1.25320	0.98020	-0.81173
24.0	0.24252	-6.15248	-7.94442	116.0	1.21188	0.83459	-0.95735
26.0	0.28200	-5.49753	-7.28947	118.0	1.16832	0.67562	-1.11631
28.0	0.32377	-4.89758	-6.68951	120.0	1.12276	0.50286	-1.28908
30.0	0.36766	-4.34554	-6.13748	122.0	1.07542	0.31577	-1.47617
32.0	0.41345	-3.83575	-5.62768	124.0	1.02654	0.11378	-1.67816
34.0	0.46094	-3.36354	-5.15548	126.0	0.97639	-0.10377	-1.89571
36.0	0.50990	-2.92511	-4.71705	128.0	0.92520	-0.37764	-2.12957
38.0	0.56011	-2.51724	-4.30918	130.0	0.87324	-0.58866	-2.38060
40.0	0.61133	-2.13726	-3.92920	132.0	0.82076	-0.85781	-2.64975
42.0	0.66331	-1.78287	-3.57480	134.0	0.76803	-1.14620	-2.93814
44.0	0.71580	-1.45211	-3.24405	136.0	0.71531	-1.45508	-3.24702
46.0	0.76854	-1.14331	-2.93525	138.0	0.66284	-1.78592	-3.57785
48.0	0.82129	-0.85502	-2.64595	140.0	0.61089	-2.14039	-3.93232
50.0	0.87378	-0.58596	-2.37790	142.0	0.55970	-2.52044	-4.31238
52.0	0.92576	-0.33503	-2.12697	144.0	0.50952	-2.92838	-4.72031
54.0	0.97695	-0.10128	-1.89321	146.0	0.46059	-3.36687	-5.15881
56.0	1.02711	0.11617	-1.67577	148.0	0.41313	-3.83913	-5.63107
58.0	1.07598	0.31804	-1.47389	150.0	0.36737	-4.34898	-6.14092
60.0	1.12331	0.50501	-1.28492	152.0	0.32351	-4.90107	-6.69300
62.0	1.16887	0.67766	-1.11428	154.0	0.28177	-5.50107	-7.29300
64.0	1.21241	0.83650	-0.95544	156.0	0.24232	-6.15606	-7.94799
66.0	1.25371	0.98198	-0.80995	158.0	0.20535	-6.87497	-8.66691
68.0	1.29256	1.11452	-0.67742	160.0	0.17103	-7.66532	-9.46125
70.0	1.32876	1.23446	-0.55748	162.0	0.13950	-8.55427	-10.34621
72.0	1.36211	1.34211	-0.44983	164.0	0.11091	-9.55040	-11.34234
74.0	1.39243	1.43775	-0.35419	166.0	0.08538	-10.68657	-12.47850
76.0	1.41958	1.52160	-0.27033	168.0	0.06302	-12.00504	-13.79698
78.0	1.44340	1.59388	-0.19806	170.0	0.04394	-13.57140	-15.36334
80.0	1.46378	1.65475	-0.13719	172.0	0.02821	-15.49550	-17.28744
82.0	1.48059	1.70435	-0.08759	174.0	0.01591	-17.98333	-19.77526
84.0	1.49375	1.74279	-0.04915	176.0	0.00708	-21.49734	-23.28928
86.0	1.50320	1.77017	-0.02177	178.0	0.00177	-27.51326	-29.30519
88.0	1.50888	1.78654	-0.00540	180.0	0.00000	-INFINITY	-INFINITY
90.0	1.51075	1.79194	0.00000				

TABLE A2-4

EPSLN= 1 0000(NORMALIZED GROUNDPLANE RADIUS)
 MONOPOLE LENGTH= 0 25000(WAVELENGTH)
 MONOPOLE RADIUS= 0 1000E-05(WAVELENGTH)
 NUMBER OF MONOPOLE SEGMENTS= 1
 NUMBER OF DISK SEGMENTS= 16
 RADIATION RESISTANCE DETERMINED BY PATTERN= 0 202095E+02 OHMS

ELEVATION ANGLE (DEG)	DIRECTIVITY (NUMERIC)	DIRECTIVITY (DBI)	RELATIVE POWER (DB)	ELEVATION ANGLE (DEG)	DIRECTIVITY (NUMERIC)	DIRECTIVITY (DBI)	RELATIVE POWER (DB)
0	0 00000	-INFINITY	-INFINITY	92.0	1 48262	1 71031	-0 00534
2.0	0 00190	-27 20604	-28 92170	94.0	1 47739	1 69494	-0 02072
4.0	0 00760	-21 19146	-22 90712	96.0	1 46875	1 66949	-0 04616
6.0	0 01706	-17 67967	-19 39533	98.0	1 45677	1 63990	-0 08176
8.0	0 03023	-15 19495	-16 91040	100.0	1 44147	1 58805	-0 12760
10.0	0 04705	-13 27481	-14 99046	102.0	1 42293	1 53182	-0 18383
12.0	0 06740	-11 71326	-13 42891	104.0	1 40121	1 46504	-0 25061
14.0	0 09119	-10 40041	-12 11607	106.0	1 37642	1 38751	-0 32814
16.0	0 11829	-9 27068	-10 98633	108.0	1 34865	1 29899	-0 41666
18.0	0 14853	-8 28174	-9 99739	110.0	1 31802	1 19921	-0 51644
20.0	0 18177	-7 40472	-9 12037	112.0	1 28465	1 08785	-0 62780
22.0	0 21782	-6 61901	-8 33466	114.0	1 24870	0 96457	-0 75109
24.0	0 25648	-5 90939	-7 62505	116.0	1 21030	0 82895	-0 88671
26.0	0 29756	-5 26432	-6 97997	118.0	1 16964	0 68054	-1 03512
28.0	0 34082	-4 67481	-6 39047	120.0	1 12689	0 51883	-1 19682
30.0	0 38603	-4 13375	-5 84941	122.0	1 08224	0 34325	-1 37240
32.0	0 43297	-3 63540	-5 35105	124.0	1 03590	0 15316	-1 56249
34.0	0 48139	-3 17506	-4 89072	126.0	0 98806	-0 05216	-1 76781
36.0	0 53102	-2 74886	-4 46451	128.0	0 93896	-0 27353	-1 98918
38.0	0 58163	-2 35353	-4 06919	130.0	0 88882	-0 51185	-2 22751
40.0	0 63295	-1 98634	-3 70199	132.0	0 83788	-0 76817	-2 48382
42.0	0 68471	-1 64492	-3 36058	134.0	0 78639	-1 04364	-2 75929
44.0	0 73667	-1 32728	-3 04293	136.0	0 73458	-1 33959	-3 05524
46.0	0 78856	-1 03166	-2 74731	138.0	0 68272	-1 65754	-3 37320
48.0	0 84013	-0 75654	-2 47219	140.0	0 63107	-1 99925	-3 71490
50.0	0 89113	-0 50060	-2 21625	142.0	0 57987	-2 36671	-4 08237
52.0	0 94131	-0 26267	-1 97832	144.0	0 52938	-2 76229	-4 47794
54.0	0 99044	-0 04171	-1 75737	146.0	0 47987	-3 18872	-4 90438
56.0	1 03829	0 16318	-1 55248	148.0	0 43159	-3 64927	-5 36493
58.0	1 08463	0 35281	-1 36285	150.0	0 38478	-4 14782	-5 86348
60.0	1 12925	0 52791	-1 18775	152.0	0 33970	-4 68906	-6 40472
62.0	1 17196	0 68911	-1 02654	154.0	0 29657	-5 27874	-6 99439
64.0	1 21255	0 83700	-0 87865	156.0	0 25563	-5 92396	-7 63961
66.0	1 25086	0 97209	-0 74357	158.0	0 21708	-6 63371	-8 34936
68.0	1 28671	1 09482	-0 62084	160.0	0 18115	-7 41954	-9 13519
70.0	1 31976	1 20560	-0 51005	162.0	0 14802	-8 29667	-10 01232
72.0	1 35045	1 30479	-0 41086	164.0	0 11788	-9 28569	-11 00135
74.0	1 37807	1 39271	-0 32295	166.0	0 09088	-10 41531	-12 13117
76.0	1 40269	1 46562	-0 24603	168.0	0 06717	-11 72843	-13 44408
78.0	1 42422	1 53577	-0 17988	170.0	0 04688	-13 29004	-15 00569
80.0	1 44257	1 59136	-0 12429	172.0	0 03013	-15 21022	-16 92588
82.0	1 45766	1 63655	-0 07910	174.0	0 01700	-17 69499	-19 41064
84.0	1 46943	1 67149	-0 04416	176.0	0 00757	-21 20680	-22 92246
86.0	1 47784	1 69627	-0 01938	178.0	0 00190	-27 22140	-28 93705
88.0	1 48285	1 71098	-0 00467	180.0	0 00000	-INFINITY	-INFINITY
90.0	1 48445	1 71565	0 00000				

TABLE A2-5

EPSLN= 1 2500(NORMALIZED GROUNDPLANE RADIUS)
 MONOPOLE LENGTH= 0 250000(WAVELENGTH)
 MONOPOLE RADIUS= 0 1000E-05(WAVELENGTH)
 NUMBER OF MONOPOLE SEGMENTS= 1
 NUMBER OF DISK SEGMENTS= 16
 RADIATION RESISTANCE DETERMINED BY PATTERN= 0 207151E+02 OHMS

ELEVATION ANGLE (DEG)	DIRECTIVITY (NUMERIC)	DIRECTIVITY (DBI)	RELATIVE POWER (DB)	ELEVATION ANGLE (DEG)	DIRECTIVITY (NUMERIC)	DIRECTIVITY (DBI)	RELATIVE POWER (DB)
0	0.00000	-INFINITY	-INFINITY	92.0	1.44640	1.60287	-0.00548
2.0	0.00209	-26.77916	-28.40031	94.0	1.44168	1.58867	-0.01967
4.0	0.00836	-20.77914	-22.38749	96.0	1.43407	1.56571	-0.04264
6.0	0.01875	-17.27027	-18.87862	98.0	1.42360	1.53387	-0.07447
8.0	0.03319	-14.78961	-16.39796	100.0	1.41028	1.49505	-0.11529
10.0	0.05159	-12.87468	-14.48302	102.0	1.39414	1.44308	-0.16527
12.0	0.07380	-11.31944	-12.92779	104.0	1.37523	1.38374	-0.22460
14.0	0.09968	-10.01400	-11.62235	106.0	1.35357	1.31480	-0.29354
16.0	0.12904	-8.89272	-10.50107	108.0	1.32922	1.23597	-0.37238
18.0	0.16169	-7.91327	-9.52161	110.0	1.30224	1.14691	-0.46143
20.0	0.19739	-7.04671	-8.65506	112.0	1.27270	1.04726	-0.56109
22.0	0.23592	-6.27240	-7.88075	114.0	1.24068	0.93658	-0.67177
24.0	0.27701	-5.57508	-7.18343	116.0	1.20626	0.81441	-0.79394
26.0	0.32039	-4.94314	-6.55149	118.0	1.16956	0.68021	-0.92814
28.0	0.36580	-4.36755	-5.97590	120.0	1.13068	0.53339	-1.07495
30.0	0.41294	-3.84114	-5.44948	122.0	1.08976	0.37331	-1.23504
32.0	0.46152	-3.35809	-4.96644	124.0	1.04694	0.19923	-1.40912
34.0	0.51125	-2.91366	-4.52201	126.0	1.00239	0.01035	-1.59800
36.0	0.56184	-2.50388	-4.11223	128.0	0.95626	-0.19423	-1.80258
38.0	0.61299	-2.12544	-3.73379	130.0	0.90876	-0.41552	-2.02386
40.0	0.66443	-1.77551	-3.38385	132.0	0.86008	-0.65461	-2.26296
42.0	0.71587	-1.45166	-3.06000	134.0	0.81044	-0.91278	-2.52113
44.0	0.76704	-1.15179	-2.76014	136.0	0.76007	-1.19144	-2.79979
46.0	0.81769	-0.87409	-2.48244	138.0	0.70922	-1.49219	-3.10054
48.0	0.86757	-0.61696	-2.22530	140.0	0.65813	-1.81687	-3.42521
50.0	0.91644	-0.37896	-1.98731	142.0	0.60708	-2.16755	-3.77590
52.0	0.96408	-0.15887	-1.76721	144.0	0.55633	-2.54669	-4.15503
54.0	1.01029	0.04445	-1.56389	146.0	0.50616	-2.93709	-4.56544
56.0	1.05487	0.23200	-1.37635	148.0	0.45687	-3.40210	-5.01045
58.0	1.09766	0.40466	-1.20369	150.0	0.40873	-3.88567	-5.49402
60.0	1.13848	0.56325	-1.04510	152.0	0.36203	-4.41256	-6.02091
62.0	1.17720	0.70849	-0.89985	154.0	0.31706	-4.98857	-6.59692
64.0	1.21368	0.84104	-0.76730	156.0	0.27410	-5.62089	-7.22923
66.0	1.24781	0.96149	-0.64685	158.0	0.23342	-6.31854	-7.92689
68.0	1.27949	1.07038	-0.53797	160.0	0.19529	-7.09315	-8.70150
70.0	1.30863	1.16817	-0.44018	162.0	0.15996	-7.95997	-9.56832
72.0	1.33515	1.25530	-0.35305	164.0	0.12765	-8.93965	-10.54800
74.0	1.35898	1.33215	-0.27620	166.0	0.09860	-10.06112	-11.66947
76.0	1.38008	1.39905	-0.20930	168.0	0.07300	-11.36673	-12.97508
78.0	1.39839	1.45629	-0.15206	170.0	0.05103	-12.92210	-14.53045
80.0	1.41388	1.50413	-0.10422	172.0	0.03283	-14.83715	-16.44549
82.0	1.42652	1.54278	-0.06557	174.0	0.01854	-17.31789	-18.92623
84.0	1.43629	1.57241	-0.03593	176.0	0.00827	-20.82682	-22.43517
86.0	1.44316	1.59316	-0.01519	178.0	0.00207	-26.83968	-28.44802
88.0	1.44714	1.60512	-0.00323	180.0	0.00000	-INFINITY	-INFINITY
90.0	1.44822	1.60835	0.00000				

TABLE A2-6

EPSLN= 1 5000(NORMALIZED GROUNDPLANE RADIUS)
 MONOPOLE LENGTH= 0 25000(WAVELENGTH)
 MONOPOLE RADIUS= 0 1000E-05(WAVELENGTH)
 NUMBER OF MONOPOLE SEGMENTS= 1
 NUMBER OF DISK SEGMENTS= 16
 RADIATION RESISTANCE DETERMINED BY PATTERN= 0 212521E+02 OHMS

ELEVATION ANGLE (DEG)	DIRECTIVITY (NUMERIC)	DIRECTIVITY (DBI)	RELATIVE POWER (DB)	ELEVATION ANGLE (DEG)	DIRECTIVITY (NUMERIC)	DIRECTIVITY (DBI)	RELATIVE POWER (DB)
0	0 00000	-INFINITY	-INFINITY	92.0	1 40824	1 48675	-0 01349
2 0	0 00235	-26 29046	-27 79070	94.0	1 40247	1 46893	-0 03131
4 0	0 00938	-20 27942	-21 77966	96.0	1 39434	1 44368	-0 05456
6 0	0 02102	-16 77352	-18 27376	98.0	1 38386	1 41093	-0 08931
8 0	0 03718	-14 29701	-15 79725	100.0	1 37105	1 37053	-0 12971
10.0	0 05771	-12 38738	-13 88761	102.0	1 35591	1 32232	-0 17792
12.0	0 08244	-10 83859	-12 33882	104.0	1 33846	1 26605	-0 23419
14.0	0 11116	-9 34071	-11 04094	106.0	1 31870	1 20147	-0 29877
16.0	0 14361	-8 42808	-9 92832	108.0	1 29665	1 12824	-0 37200
18.0	0 17954	-7 45835	-8 95859	110.0	1 27233	1 04599	-0 45425
20.0	0 21865	-6 40254	-8 10278	112.0	1 24574	0 95428	-0 54595
22.0	0 26062	-5 83997	-7 34021	114.0	1 21693	0 85265	-0 64759
24.0	0 30512	-5 15534	-6 65557	116.0	1 18592	0 74054	-0 75970
26.0	0 35180	-4 53699	-6 03723	118.0	1 15275	0 61735	-0 88289
28.0	0 40033	-3 97586	-5 47610	120.0	1 11749	0 48243	-1 01781
30.0	0 45033	-3 46470	-4 96494	122.0	1 08020	0 33503	-1 16521
32.0	0 50146	-2 99767	-4 49791	124.0	1 04096	0 17434	-1 32590
34.0	0 55336	-2 56995	-4 07018	126.0	0 99988	-0 00052	-1 50076
36.0	0 60569	-2 17752	-3 67776	128.0	0 95707	-0 19056	-1 69080
38.0	0 65811	-1 81699	-3 31723	130.0	0 91267	-0 39685	-1 89709
40.0	0 71032	-1 48548	-2 98572	132.0	0 86684	-0 62062	-2 12085
42.0	0 76199	-1 18049	-2 68073	134.0	0 81975	-0 86320	-2 36344
44.0	0 81286	-0 89986	-2 40010	136.0	0 77159	-1 12612	-2 62635
46.0	0 86264	-0 64169	-2 14193	138.0	0 72259	-1 41106	-2 91130
48.0	0 91111	-0 40429	-1 90453	140.0	0 67298	-1 71995	-3 22019
50.0	0 95803	-0 18619	-1 68843	142.0	0 62302	-2 03497	-3 55321
52.0	1 00322	0 01396	-1 48628	144.0	0 57297	-2 41866	-3 91889
54.0	1 04649	0 19735	-1 30289	146.0	0 52313	-2 81390	-4 31414
56.0	1 08769	0 36505	-1 13318	148.0	0 47379	-3 24413	-4 74437
58.0	1 12670	0 51806	-0 98217	150.0	0 42527	-3 71338	-5 21362
60.0	1 16339	0 65726	-0 84298	152.0	0 37788	-4 22649	-5 72673
62.0	1 19770	0 78346	-0 71677	154.0	0 33195	-4 78933	-6 28957
64.0	1 22953	0 89741	-0 60283	156.0	0 28780	-5 40916	-6 90940
66.0	1 25886	0 99976	-0 50048	158.0	0 24575	-6 09508	-7 59332
68.0	1 28563	1 09115	-0 40909	160.0	0 20612	-6 85876	-8 35899
70.0	1 30982	1 17213	-0 32811	162.0	0 16922	-7 71551	-9 21575
72.0	1 33143	1 24320	-0 25704	164.0	0 13533	-8 68604	-10 18628
74.0	1 35046	1 30482	-0 19542	166.0	0 10473	-9 79933	-11 29957
76.0	1 36691	1 35740	-0 14288	168.0	0 07766	-10 9776	-12 59800
78.0	1 38080	1 40131	-0 09893	170.0	0 05436	-12 46700	-14 14724
80.0	1 39215	1 43686	-0 06338	172.0	0 03502	-14 55698	-16 05722
82.0	1 40098	1 46432	-0 03592	174.0	0 01980	-17 03376	-18 53400
84.0	1 40732	1 48392	-0 01632	176.0	0 00883	-20 53985	-22 04008
86.0	1 41119	1 49585	-0 00439	178.0	0 00221	-26 55099	-28 05123
88.0	1 41262	1 50024	0 00000	180.0	0 00000	-INFINITY	-INFINITY
90.0	1 41162	1 49719	-0 00305				

TABLE A2-7

EPSLN= 1.7500(NORMALIZED GROUNDPLANE RADIUS)
 MONOPOLE LENGTH= 0.250000(WAVELENGTH)
 MONOPOLE RADIUS= 0.1000E-05(WAVELENGTH)
 NUMBER OF MONOPOLE SEGMENTS= 1
 NUMBER OF DISK SEGMENTS= 16
 RADIATION RESISTANCE DETERMINED BY PATTERN= 0.224457E+02 OHMS

ELEVATION ANGLE (DEG)	DIRECTIVITY (NUMERIC)	DIRECTIVITY (DBI)	RELATIVE POWER (DB)	ELEVATION ANGLE (DEG)	DIRECTIVITY (NUMERIC)	DIRECTIVITY (DBI)	RELATIVE POWER (DB)
0	0.00000	-INFINITY	-INFINITY	92.0	1.33361	1.25028	-0.01516
2.0	0.00279	-25.55117	-26.81661	94.0	1.32928	1.23617	-0.02928
4.0	0.01111	-19.54315	-20.80860	96.0	1.32357	1.21747	-0.04797
6.0	0.02488	-16.04227	-17.30771	98.0	1.31646	1.19408	-0.07137
8.0	0.04393	-13.57276	-14.83821	100.0	1.30791	1.16577	-0.09967
10.0	0.06804	-11.67211	-12.93755	102.0	1.29786	1.13229	-0.13316
12.0	0.09696	-10.13423	-11.39967	104.0	1.28626	1.09330	-0.17215
14.0	0.13034	-8.84916	-10.11460	106.0	1.27303	1.04839	-0.21705
16.0	0.16783	-7.75121	-9.01665	108.0	1.25809	0.99710	-0.26834
18.0	0.20903	-6.79797	-8.06341	110.0	1.24134	0.93890	-0.32654
20.0	0.25349	-5.96041	-7.22586	112.0	1.22270	0.87318	-0.39226
22.0	0.30076	-5.21780	-6.48325	114.0	1.20207	0.79929	-0.46615
24.0	0.35037	-4.55477	-5.82022	116.0	1.17937	0.71650	-0.54895
26.0	0.40183	-3.95960	-5.22504	118.0	1.15452	0.62401	-0.64144
28.0	0.45466	-3.42312	-4.68856	120.0	1.12745	0.52096	-0.74448
30.0	0.50839	-2.93802	-4.20346	122.0	1.09810	0.40643	-0.85901
32.0	0.56255	-2.49836	-3.76380	124.0	1.06645	0.27941	-0.98604
34.0	0.61671	-2.09922	-3.36466	126.0	1.03248	0.13880	-1.12665
36.0	0.67043	-1.73648	-3.00192	128.0	0.99619	-0.01637	-1.28201
38.0	0.72333	-1.40665	-2.67209	130.0	0.95764	-0.18798	-1.45342
40.0	0.77505	-1.10670	-2.37214	132.0	0.91689	-0.37681	-1.64225
42.0	0.82527	-0.83403	-2.09947	134.0	0.87406	-0.58460	-1.85004
44.0	0.87371	-0.58633	-1.85177	136.0	0.82928	-0.81301	-2.07845
46.0	0.92012	-0.36157	-1.62701	138.0	0.78272	-1.06391	-2.32935
48.0	0.96429	-0.15791	-1.42336	140.0	0.73462	-1.33937	-2.60481
50.0	1.00607	0.02627	-1.23917	142.0	0.68522	-1.64172	-2.90716
52.0	1.04532	0.19249	-1.07296	144.0	0.63480	-1.97362	-3.23906
54.0	1.08195	0.34209	-0.92335	146.0	0.58370	-2.33810	-3.60354
56.0	1.11592	0.47633	-0.78911	148.0	0.53227	-2.73870	-4.00414
58.0	1.14720	0.59638	-0.66907	150.0	0.48089	-3.17957	-4.44502
60.0	1.17579	0.70329	-0.56215	152.0	0.42997	-3.66566	-4.93110
62.0	1.20173	0.79807	-0.46738	154.0	0.37993	-4.20294	-5.46838
64.0	1.22508	0.88163	-0.38381	156.0	0.33123	-4.79874	-6.06419
66.0	1.24591	0.95485	-0.31059	158.0	0.28430	-5.46226	-6.72771
68.0	1.26431	1.01852	-0.24592	160.0	0.23959	-6.20524	-7.47069
70.0	1.28038	1.07338	-0.19206	162.0	0.19756	-7.04307	-8.30851
72.0	1.29423	1.12012	-0.14532	164.0	0.15862	-7.99650	-9.26195
74.0	1.30598	1.15937	-0.10608	166.0	0.12318	-9.09458	-10.36002
76.0	1.31574	1.19169	-0.07375	168.0	0.09163	-10.37973	-11.64517
78.0	1.32361	1.21761	-0.04783	170.0	0.06430	-11.91766	-13.18310
80.0	1.32971	1.23758	-0.02787	172.0	0.04151	-13.81634	-15.08378
82.0	1.33413	1.25199	-0.01345	174.0	0.02351	-16.28786	-17.59330
84.0	1.33696	1.26119	-0.00425	176.0	0.01050	-19.78874	-21.05418
86.0	1.33827	1.26544	0.00000	178.0	0.00263	-25.79676	-27.06220
88.0	1.33812	1.26496	-0.00048	180	0.00000	-INFINITY	-INFINITY
90.0	1.33656	1.25988	-0.00356				

TABLE A2-8

EPSLN 2 0000(NORMALIZED GROUNDPLANE RADIUS)
 MONOPOLE LENGTH= 0 250000(WAVELENGTH)
 MONOPOLE RADIUS= 0 1000E-05(WAVELENGTH)
 NUMBER OF MONOPOLE SEGMENTS= 1
 NUMBER OF DISK SEGMENTS= 16
 RADIATION RESISTANCE DETERMINED BY PATTERN= 0 238990E+02 OHMS

ELEVATION ANGLE (DEG)	DIRECTIVITY (NUMERIC)	DIRECTIVITY (DBI)	RELATIVE POWER (DB)	ELEVATION ANGLE (DEG)	DIRECTIVITY (NUMERIC)	DIRECTIVITY (DBI)	RELATIVE POWER (DB)
0	0 00000	-INFINITY	-INFINITY	92 0	1 25046	0 97070	-0 08131
2 0	0 00340	-24 69016	-25 74217	94 0	1 24530	0 95273	-0 09929
4 0	0 01354	-18 68510	-19 73712	96 0	1 23979	0 93347	-0 11854
6 0	0 03028	-15 18915	-16 24116	98 0	1 23390	0 91280	-0 13921
8 0	0 05338	-12 72653	-13 77854	100 0	1 22757	0 89048	-0 16153
10 0	0 08251	-10 83469	-11 88670	102 0	1 22072	0 86616	-0 18585
12 0	0 11729	-9 30755	-10 35956	104 0	1 21322	0 83941	-0 21260
14 0	0 15721	-8 03512	-9 08713	106 0	1 20495	0 80970	-0 24231
16 0	0 20176	-6 95167	-8 00368	108 0	1 19575	0 77640	-0 27561
18 0	0 25034	-6 01475	-7 06676	110 0	1 18544	0 73880	-0 31321
20 0	0 30232	-5 19531	-6 24732	112 0	1 17385	0 69612	-0 35589
22 0	0 35706	-4 47257	-5 52458	114 0	1 16077	0 64748	-0 40454
24 0	0 41390	-3 83110	-4 88311	116 0	1 14602	0 59192	-0 46009
26 0	0 47216	-3 25913	-4 31114	118 0	1 12939	0 52843	-0 52358
28 0	0 53120	-2 74744	-3 79946	120 0	1 11069	0 45591	-0 59610
30 0	0 59038	-2 28867	-3 34068	122 0	1 08973	0 37320	-0 67881
32 0	0 64911	-1 87679	-2 92880	124 0	1 06637	0 27906	-0 77295
34 0	0 70683	-1 50683	-2 55884	126 0	1 04044	0 17217	-0 87984
36 0	0 76303	-1 17457	-2 22658	128 0	1 01184	0 05113	-1 00088
38 0	0 81725	-0 87645	-1 92846	130 0	0 98049	-0 08556	-1 13757
40 0	0 86909	-0 60936	-1 66137	132 0	0 94635	-0 23950	-1 29151
42 0	0 91821	-0 37058	-1 42259	134 0	0 90941	-0 41240	-1 46441
44 0	0 96434	-0 15771	-1 20972	136 0	0 86973	-0 60614	-1 65815
46 0	1 00725	0 03139	-1 02063	138 0	0 82742	-0 82275	-1 87476
48 0	1 04681	0 19866	-0 85335	140 0	0 78262	-1 06447	-2 11648
50 0	1 08290	0 34588	-0 70613	142 0	0 73556	-1 33380	-2 38381
52 0	1 11550	0 47468	-0 57733	144 0	0 68451	-1 63353	-2 68554
54 0	1 14461	0 58656	-0 46545	146 0	0 63579	-1 96685	-3 01886
56 0	1 17029	0 68293	-0 36908	148 0	0 58379	-2 33742	-3 38943
58 0	1 19265	0 76512	-0 28690	150 0	0 53094	-2 74951	-3 80152
60 0	1 21181	0 83436	-0 21766	152 0	0 47773	-3 20818	-4 26019
62 0	1 22796	0 89183	-0 16018	154 0	0 42467	-3 71950	-4 77151
64 0	1 24127	0 93866	-0 11335	156 0	0 37231	-4 29091	-5 34292
66 0	1 25196	0 97591	-0 07610	158 0	0 32124	-4 93168	-5 98369
68 0	1 26026	1 00460	-0 04742	160 0	0 27204	-5 65363	-6 70564
70 0	1 26639	1 02567	-0 02634	162 0	0 22531	-6 47222	-7 52423
72 0	1 27058	1 04003	-0 01198	164 0	0 18162	-7 40828	-8 46028
74 0	1 27308	1 04855	-0 00346	166 0	0 14155	-8 47089	-9 54290
76 0	1 27409	1 05201	0 00000	168 0	0 10562	-9 76254	-10 81456
78 0	1 27384	1 05115	-0 00086	170 0	0 07432	-11 28897	-12 34099
80 0	1 27252	1 04664	-0 00537	172 0	0 04808	-13 18020	-14 23222
82 0	1 27030	1 03907	-0 01294	174 0	0 02728	-15 64234	-16 69435
84 0	1 26735	1 02897	-0 02304	176 0	0 01220	-19 13793	-20 18994
86 0	1 26380	1 01677	-0 03524	178 0	0 00306	-25 14277	-26 19478
88 0	1 25975	1 00284	-0 04917	180	0 00000	-INFINITY	-INFINITY
90 0	1 25529	0 98742	-0 06459				

TABLE A2-9

EPSLN= 2.4500E-05 (NORMALIZED GROUNDPLANE RADIUS)
 MONOPOLE LENGTH= 0.250000 (WAVELENGTH)
 MONOPOLE RADIUS= 0.1000E-05 (WAVELENGTH)
 NUMBER OF MONOPOLE SEGMENTS= 1
 NUMBER OF DISK SEGMENTS= 16
 RADIATION RESISTANCE DETERMINED BY PATTERN= 0.259969E+02 OHMS

ELEVATION ANGLE (DEG)	DIRECTIVITY (NUMERIC)	DIRECTIVITY (DBI)	RELATIVE POWER (DB)	ELEVATION ANGLE (DEG)	DIRECTIVITY (NUMERIC)	DIRECTIVITY (DBI)	RELATIVE POWER (DB)
0	0.00000	-INFINITY	-INFINITY	92.0	1.14569	0.59069	-0.44778
2.0	0.00429	-23.67209	-24.71056	94.0	1.13828	0.56249	-0.47598
4.0	0.01710	-17.67022	-18.70869	96.0	1.13175	0.53749	-0.50098
6.0	0.03820	-15.72957	-15.21804	98.0	1.12606	0.51560	-0.52286
8.0	0.06723	-11.72436	-12.76283	100.0	1.12114	0.49660	-0.54186
10.0	0.10370	-9.84203	-10.88050	102.0	1.11689	0.48009	-0.55838
12.0	0.14701	-8.32648	-9.36494	104.0	1.11314	0.46550	-0.57597
14.0	0.19644	-7.06768	-8.10614	106.0	1.10972	0.45214	-0.58633
16.0	0.25120	-5.99989	-7.03835	108.0	1.10641	0.43916	-0.59930
18.0	0.31041	-5.08063	-6.11910	110.0	1.10296	0.42560	-0.61287
20.0	0.37318	-4.28082	-5.31928	112.0	1.09910	0.41036	-0.62811
22.0	0.43857	-3.57962	-4.61809	114.0	1.09452	0.39225	-0.64622
24.0	0.50564	-2.96160	-4.00006	116.0	1.08992	0.36998	-0.66849
26.0	0.57347	-2.41492	-3.45339	118.0	1.08198	0.34218	-0.69629
28.0	0.64116	-1.93033	-2.96879	120.0	1.07335	0.30740	-0.73107
30.0	0.70788	-1.50040	-2.53886	122.0	1.06271	0.26413	-0.77433
32.0	0.77285	-1.11906	-2.15753	124.0	1.04973	0.21079	-0.82768
34.0	0.83536	-0.78128	-1.81975	126.0	1.03412	0.14572	-0.89274
36.0	0.89479	-0.48280	-1.52127	128.0	1.01560	0.06722	-0.97125
38.0	0.95061	-0.21997	-1.25844	130.0	0.99391	-0.02652	-1.06499
40.0	1.00239	0.01038	-1.02809	132.0	0.96886	-0.13738	-1.17585
42.0	1.04979	0.21103	-0.82744	134.0	0.94030	-0.26734	-1.30981
44.0	1.09256	0.38446	-0.65400	136.0	0.90813	-0.41851	-1.45698
46.0	1.13055	0.53291	-0.50555	138.0	0.87234	-0.59315	-1.63162
48.0	1.16370	0.65841	-0.38005	140.0	0.83297	-0.79371	-1.83218
50.0	1.19202	0.76284	-0.27563	142.0	0.79015	-1.02288	-2.06135
52.0	1.21561	0.84793	-0.19054	144.0	0.74411	-1.28209	-2.32209
54.0	1.23461	0.91531	-0.12316	146.0	0.69514	-1.57929	-2.61776
56.0	1.24926	0.96653	-0.07193	148.0	0.64362	-1.91368	-2.95215
58.0	1.25981	1.00307	-0.03540	150.0	0.59004	-2.29120	-3.32967
60.0	1.26658	1.02633	-0.01214	152.0	0.53493	-2.71702	-3.75549
62.0	1.26990	1.03769	-0.00078	154.0	0.47892	-3.19734	-4.23580
64.0	1.27013	1.03847	0.00000	156.0	0.42270	-3.73967	-4.77813
66.0	1.26764	1.02996	-0.00851	158.0	0.36700	-4.35338	-5.39185
68.0	1.26282	1.01342	-0.02505	160.0	0.31258	-5.05038	-6.08885
70.0	1.25605	0.99008	-0.04839	162.0	0.26024	-5.84619	-6.88465
72.0	1.24771	0.96114	-0.07733	164.0	0.21078	-6.76170	-7.80016
74.0	1.23816	0.92776	-0.11071	166.0	0.16497	-7.82605	-8.86452
76.0	1.22774	0.89106	-0.14741	168.0	0.12354	-9.08179	-10.12025
78.0	1.21677	0.85210	-0.18636	170.0	0.08720	-10.59468	-11.63315
80.0	1.20557	0.81191	-0.22656	172.0	0.05656	-12.47479	-13.51325
82.0	1.19438	0.77141	-0.26705	174.0	0.03215	-14.92824	-15.96671
84.0	1.18344	0.73147	-0.30699	176.0	0.01440	-18.41762	-19.45608
86.0	1.17296	0.69284	-0.34562	178.0	0.00362	-24.41872	-25.45719
88.0	1.16310	0.65618	-0.38229	180	0.00000	-INFINITY	-INFINITY
90.0	1.15398	0.62200	-0.41647				

TABLE A2-10

EPSLNF 2 5000(NORMALIZED GROUNDFLANE RADIUS)
 MONOPOLE LENGTH= 0 250000(WAVELENGTH)
 MONOPOLE RADIUS= 0 1000E-05(WAVELENGTH)
 NUMBER OF MONOPOLE SEGMENTS= 1
 NUMBER OF DISK SEGMENTS= 16
 RADIATION RESISTANCE DETERMINED BY PATTERN= 0 290198E+02 OHMS

ELEVATION ANGLE (DEG)	DIRECTIVITY (NUMERIC)	DIRECTIVITY (DBI)	RELATIVE POWER (DB)	ELEVATION ANGLE (DEG)	DIRECTIVITY (NUMERIC)	DIRECTIVITY (DBI)	RELATIVE POWER (DB)
0	0.00000	-INFINITY	-INFINITY	92.0	1.01981	0.08519	-1.24763
2.0	0.00358	-22.53282	-23.86563	94.0	1.00804	0.03476	-1.29805
4.0	0.02221	-16.53422	-17.86704	96.0	0.99849	-0.00655	-1.33937
6.0	0.04956	-13.04902	-14.38183	98.0	0.99116	-0.03856	-1.37138
8.0	0.08707	-10.60142	-11.93423	100.0	0.98597	-0.06135	-1.39417
10.0	0.13400	-8.72885	-10.06166	102.0	0.98282	-0.07525	-1.40807
12.0	0.18944	-7.22518	-8.55800	104.0	0.98154	-0.08090	-1.41372
14.0	0.25233	-5.98038	-7.31320	106.0	0.98193	-0.07919	-1.41200
16.0	0.32146	-4.92868	-6.26150	108.0	0.98373	-0.07123	-1.40405
18.0	0.39359	-4.02757	-5.36039	110.0	0.98665	-0.05838	-1.39120
20.0	0.47338	-3.24793	-4.58074	112.0	0.99033	-0.04219	-1.37500
22.0	0.55349	-2.56890	-3.90172	114.0	0.99441	-0.02433	-1.35715
24.0	0.63460	-1.97499	-3.30781	116.0	0.99847	-0.00665	-1.33946
26.0	0.71542	-1.45436	-2.78718	118.0	1.00206	0.00894	-1.32388
28.0	0.79475	-0.99770	-2.33051	120.0	1.00471	0.02043	-1.31239
30.0	0.87146	-0.59754	-1.93036	122.0	1.00595	0.02575	-1.30707
32.0	0.94454	-0.24779	-1.58060	124.0	1.00526	0.02280	-1.31002
34.0	1.01313	0.05665	-1.27617	126.0	1.00217	0.00942	-1.32340
36.0	1.07648	0.32005	-1.01276	128.0	0.99620	-0.01656	-1.34937
38.0	1.13400	0.54612	-0.78669	130.0	0.98688	-0.03736	-1.39017
40.0	1.18524	0.73806	-0.59476	132.0	0.97381	-0.11525	-1.44807
42.0	1.22990	0.89869	-0.43412	134.0	0.95683	-0.19258	-1.52540
44.0	1.26781	1.03054	-0.30228	136.0	0.93502	-0.29177	-1.62459
46.0	1.29894	1.13588	-0.19694	138.0	0.90879	-0.41536	-1.74818
48.0	1.32336	1.21679	-0.11603	140.0	0.87780	-0.56605	-1.89887
50.0	1.34128	1.27520	-0.05762	142.0	0.84203	-0.74675	-2.07957
52.0	1.35277	1.31288	-0.01993	144.0	0.80156	-0.96062	-2.29344
54.0	1.35880	1.33155	-0.00127	146.0	0.75662	-1.21120	-2.54401
56.0	1.35920	1.33282	0.00000	148.0	0.70755	-1.50242	-2.83524
58.0	1.35464	1.31824	-0.01458	150.0	0.65481	-1.83884	-3.17166
60.0	1.34565	1.28933	-0.04348	152.0	0.59900	-2.22575	-3.55857
62.0	1.33278	1.24759	-0.08522	154.0	0.54082	-2.66944	-4.00226
64.0	1.31659	1.19449	-0.13832	156.0	0.48111	-3.17754	-4.51036
66.0	1.29763	1.13151	-0.20131	158.0	0.42078	-3.75948	-5.09230
68.0	1.27647	1.06011	-0.27271	160.0	0.36081	-4.42725	-5.76007
70.0	1.25365	0.98178	-0.35104	162.0	0.30224	-5.19643	-6.52925
72.0	1.22971	0.89802	-0.43480	164.0	0.24615	-6.08798	-7.42080
74.0	1.20513	0.81033	-0.52249	166.0	0.19359	-7.13108	-8.46390
76.0	1.18038	0.72022	-0.61259	168.0	0.14560	-8.36831	-9.70113
78.0	1.15590	0.62922	-0.70360	170.0	0.10315	-9.86549	-11.19831
80.0	1.13209	0.53880	-0.79402	172.0	0.06710	-11.73270	-13.06552
82.0	1.10929	0.45044	-0.88238	174.0	0.03823	-14.17610	-15.50891
84.0	1.08781	0.36554	-0.96728	176.0	0.01715	-17.65828	-18.99110
86.0	1.06793	0.28542	-1.04740	178.0	0.00431	-23.65506	-24.98788
88.0	1.04986	0.21131	-1.12151	180.0	0.00000	-INFINITY	-INFINITY
90.0	1.03378	0.14426	-1.18855				

TABLE A2-11

EP5LN= 2 '500(NORMALIZED GROUNDPLANE RADIUS,
 MONDPOLE LENGTH= 0.250000(WAVELENGTH,
 MONDPOLE RADIUS= 0.1000E-05(WAVELENGTH),
 NUMBER OF MONDPOLE SEGMENTS= 1
 NUMBER OF DISK SEGMENTS= 16
 RADIATION RESISTANCE DETERMINED BY PATTERN= 0.332407E+02 OHMS

ELEVATION ANGLE (DEG)	DIRECTIVITY (NUMERIC)	DIRECTIVITY (DBI)	RELATIVE POWER (DB)	ELEVATION ANGLE (DEG)	DIRECTIVITY (NUMERIC)	DIRECTIVITY (DBI)	RELATIVE POWER (DB)
0	0.00000	-INFINITY	-INFINITY	92.0	0.88037	-0.55334	-2.40331
2.0	0.00734	-21.34301	-23.19298	94.0	0.86170	-0.64644	-2.49641
4.0	0.02919	-15.34767	-17.19764	96.0	0.84657	-0.72340	-2.57337
6.0	0.06504	-11.86788	-13.71785	98.0	0.83499	-0.78318	-2.63315
8.0	0.11408	-9.42784	-11.27781	100.0	0.82695	-0.82521	-2.67518
10.0	0.17519	-7.56495	-9.41492	102.0	0.82236	-0.84936	-2.69932
12.0	0.24700	-6.07308	-7.92305	104.0	0.82110	-0.85603	-2.70600
14.0	0.32793	-4.84215	-6.69212	106.0	0.82298	-0.84613	-2.69610
16.0	0.41626	-3.80637	-5.65634	108.0	0.82774	-0.82105	-2.67102
18.0	0.51013	-2.92319	-4.77316	110.0	0.83510	-0.78260	-2.63257
20.0	0.60765	-2.16346	-4.01343	112.0	0.84470	-0.73298	-2.58295
22.0	0.70692	-1.50628	-3.35625	114.0	0.85612	-0.67467	-2.52464
24.0	0.80610	-0.93611	-2.78608	116.0	0.86888	-0.61038	-2.46035
26.0	0.90343	-0.44107	-2.29104	118.0	0.88248	-0.54296	-2.39293
28.0	0.99728	-0.01181	-1.86178	120.0	0.89632	-0.47536	-2.32532
30.0	1.08622	0.35917	-1.49080	122.0	0.90980	-0.41053	-2.26050
32.0	1.16897	0.67802	-1.17194	124.0	0.92226	-0.35146	-2.20143
34.0	1.24448	0.94987	-0.90010	126.0	0.93302	-0.30108	-2.15105
36.0	1.31191	1.17903	-0.67094	128.0	0.94139	-0.26229	-2.11226
38.0	1.37064	1.36923	-0.48074	130.0	0.94668	-0.23795	-2.08792
40.0	1.42037	1.52370	-0.32627	132.0	0.94823	-0.23088	-2.08085
42.0	1.46059	1.64529	-0.20468	134.0	0.94539	-0.24391	-2.09387
44.0	1.49160	1.73652	-0.11345	136.0	0.93759	-0.27987	-2.12984
46.0	1.51345	1.79969	-0.05028	138.0	0.92434	-0.34167	-2.19164
48.0	1.52646	1.83687	-0.01310	140.0	0.90525	-0.43230	-2.28227
50.0	1.53108	1.84997	0.00000	142.0	0.88005	-0.55493	-2.40490
52.0	1.52784	1.84078	-0.00919	144.0	0.84861	-0.71294	-2.56290
54.0	1.51739	1.81097	-0.03900	146.0	0.81096	-0.91001	-2.75998
56.0	1.50042	1.76214	-0.08783	148.0	0.76731	-1.15027	-3.00024
58.0	1.47769	1.69583	-0.15414	150.0	0.71806	-1.43837	-3.28834
60.0	1.44995	1.61352	-0.23644	152.0	0.66379	-1.77972	-3.62969
62.0	1.41799	1.51672	-0.33325	154.0	0.60524	-2.18070	-4.03067
64.0	1.38257	1.40689	-0.44308	156.0	0.54337	-2.64901	-4.49898
66.0	1.34447	1.28552	-0.56445	158.0	0.47927	-3.19415	-5.04412
68.0	1.30442	1.15416	-0.69581	160.0	0.41417	-3.82816	-5.67813
70.0	1.26310	1.01438	-0.83559	162.0	0.34941	-4.56669	-6.41665
72.0	1.22119	0.86782	-0.98215	164.0	0.28637	-5.43070	-7.28067
74.0	1.17929	0.71620	-1.13376	166.0	0.22649	-6.44944	-8.29940
76.0	1.13798	0.56134	-1.28863	168.0	0.17118	-7.66549	-9.51546
78.0	1.09777	0.40512	-1.44484	170.0	0.12177	-9.14472	-10.99449
80.0	1.05914	0.24954	-1.60043	172.0	0.07948	-10.99721	-12.84718
82.0	1.02250	0.09665	-1.75332	174.0	0.04540	-13.42915	-15.27912
84.0	0.98823	-0.05143	-1.90140	176.0	0.02040	-16.90314	-18.75311
86.0	0.95663	-0.19256	-2.04253	178.0	0.00513	-22.89500	-24.74496
88.0	0.92798	-0.32459	-2.17456	180	0.00000	-INFINITY	-INFINITY
90.0	0.90251	-0.44549	-2.29546				

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EFSLN  J 0.0,NORMALIZED GROUNDPLANE RADIUS;
MONOPOLE LENGTH= 0 20000.0,WAVELENGTH;
MONOPOLE RADIUS= 0 10000.05,WAVELENGTH;
NUMBER OF MONOPOLE SEGMENTS= 1
NUMBER OF DISK SEGMENTS= 16
RADIATION RESISTANCE DETERMINED BY PATTERN= 0 386185E+02 OHMS

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TABLE A2-13

EPFLN= 3 2500(NORMALIZED GROUNDPLANE RADIUS)
 MONOPOLE LENGTH= 0 250000(WAVELENGTH)
 MONOPOLE RADIUS= 0 1000E-05(WAVELENGTH)
 NUMBER OF MONOPOLE SEGMENTS= 1
 NUMBER OF DISK SEGMENTS= 16
 RADIATION RESISTANCE DETERMINED BY PATTERN= 0 441233E+02 OHMS

ELEVATION ANGLE (DEG)	DIRECTIVITY (NUMERIC)	DIRECTIVITY (DBI)	RELATIVE POWER (DB)	ELEVATION ANGLE (DEG)	DIRECTIVITY (NUMERIC)	DIRECTIVITY (DBI)	RELATIVE POWER (DB)
0	0 00000	-INFINITY	-INFINITY	92.0	0.63650	-1.96205	-4.99894
2.0	0 01213	-19.16045	-22.19734	94.0	0.59793	-2.23349	-5.27039
4.0	0 04818	-13.17147	-16.20837	96.0	0.56439	-2.48423	-5.52113
6.0	0 10710	-9.70228	-12.73918	98.0	0.53601	-2.70830	-5.74520
8.0	0 18720	-7.27701	-10.31391	100.0	0.51291	-2.89962	-5.93651
10.0	0 28622	-5.43301	-8.46991	102.0	0.49518	-3.05238	-6.08927
12.0	0 40142	-3.96406	-7.00096	104.0	0.48288	-3.16160	-6.19850
14.0	0 52966	-2.76001	-5.79691	106.0	0.47603	-3.23648	-6.26057
16.0	0 66758	-1.75494	-4.79184	108.0	0.47459	-3.23679	-6.27369
18.0	0 81167	-0.90619	-3.94308	110.0	0.47849	-3.20128	-6.23818
20.0	0 95842	-0.18446	-3.22136	112.0	0.48757	-3.11966	-6.15656
22.0	1 10440	0.43127	-2.60563	114.0	0.50160	-2.99644	-6.03334
24.0	1 24644	0.95670	-2.08020	116.0	0.52027	-2.83771	-5.87460
26.0	1 38162	1.40389	-1.63301	118.0	0.54317	-2.65060	-5.68750
28.0	1 50742	1.78233	-1.25456	120.0	0.56980	-2.44280	-5.47970
30.0	1 62170	2.09972	-0.93718	122.0	0.59951	-2.22203	-5.25893
32.0	1 72280	2.36235	-0.67455	124.0	0.63158	-1.99573	-5.03263
34.0	1 80947	2.57551	-0.46138	126.0	0.66515	-1.77083	-4.80773
36.0	1 88092	2.74370	-0.29320	128.0	0.69925	-1.55366	-4.59056
38.0	1 93676	2.87076	-0.16614	130.0	0.73284	-1.34993	-4.38682
40.0	1 97700	2.96007	-0.07683	132.0	0.76476	-1.16474	-4.20164
42.0	2 00197	3.01457	0.02233	134.0	0.79383	-1.00273	-4.03963
44.0	2 01229	3.03690	0.00000	136.0	0.81882	-0.86812	-3.90502
46.0	2 00881	3.02939	-0.00751	138.0	0.83852	-0.76486	-3.80176
48.0	1 99257	2.99414	-0.04276	140.0	0.85178	-0.69673	-3.73363
50.0	1 96474	2.93305	-0.10385	142.0	0.85754	-0.66744	-3.70434
52.0	1 92657	2.84784	-0.18905	144.0	0.85491	-0.68078	-3.71768
54.0	1 87936	2.74009	-0.29681	146.0	0.84320	-0.74071	-3.77761
56.0	1 82441	2.61122	-0.42567	148.0	0.82195	-0.85153	-3.88843
58.0	1 76301	2.46256	-0.57434	150.0	0.79104	-1.01802	-4.05492
60.0	1 69641	2.29530	-0.74160	152.0	0.75065	-1.24564	-4.28254
62.0	1 62577	2.11059	-0.92630	154.0	0.70132	-1.54081	-4.57771
64.0	1 55220	1.90949	-1.12741	156.0	0.64398	-1.91124	-4.94814
66.0	1 47673	1.69300	-1.34389	158.0	0.57990	-2.36644	-5.40334
68.0	1 40027	1.46211	-1.57478	160.0	0.51069	-2.91842	-5.95532
70.0	1 32367	1.21780	-1.81910	162.0	0.43825	-3.58280	-6.61970
72.0	1 24769	0.96106	-2.07584	164.0	0.36471	-4.38055	-7.41744
74.0	1 17299	0.69294	-2.34396	166.0	0.29236	-5.34087	-8.37776
76.0	1 10017	0.41460	-2.62229	168.0	0.22355	-6.50634	-9.54324
78.0	1 02976	0.12735	-2.90955	170.0	0.16059	-7.94280	-10.97970
80.0	0 96221	-0.16732	-3.20422	172.0	0.10567	-9.76032	-12.79722
82.0	0 89792	-0.46762	-3.50451	174.0	0.06074	-12.16507	-15.20197
84.0	0 83726	-0.77141	-3.80831	176.0	0.02742	-15.61965	-18.65655
86.0	0 78052	-1.07614	-4.11304	178.0	0.00692	-21.59986	-24.63676
88.0	0 72799	-1.37872	-4.41562	180	0.00000	-INFINITY	-INFINITY
90.0	0 67991	-1.67546	-4.71236				

TABLE A2-14

EPSLN= 3 5000(NORMALIZED GROUNDPLANE RADIUS)
 MONOPOLE LENGTH= 0 250000(WAVELENGTH)
 MONOPOLE RADIUS= 0 1000E-05(WAVELENGTH)
 NUMBER OF MONOPOLE SEGMENTS= 1
 NUMBER OF DISK SEGMENTS= 16
 RADIATION RESISTANCE DETERMINED BY PATTERN= 0 475769E+02 OHMS

ELEVATION ANGLE (DEG)	DIRECTIVITY (NUMERIC)	DIRECTIVITY (DB1)	RELATIVE POWER (DB)	ELEVATION ANGLE (DEG)	DIRECTIVITY (NUMERIC)	DIRECTIVITY (DB1)	RELATIVE POWER (DB)
0	0.00000	-INFINITY	-INFINITY	92 0	0.57769	-2.38302	-5.87128
2 0	0.01475	-18.31222	-21.80048	94 0	0.52944	-2.76186	-6.25013
4 0	0.05853	-12.32650	-15.81476	96 0	0.48597	-3.13392	-6.62218
6 0	0.12994	-8.86269	-12.35095	98 0	0.44748	-3.49228	-6.98055
8 0	0.22673	-6.44492	-9.93318	100 0	0.41415	-3.82842	-7.31668
10 0	0.34590	-4.61048	-8.09874	102 0	0.38617	-4.13222	-7.62048
12 0	0.48383	-3.15309	-6.64135	104 0	0.36371	-4.39240	-7.88066
14 0	0.63643	-1.96251	-5.45078	106 0	0.34695	-4.59737	-8.08563
16 0	0.79933	-0.97276	-4.46103	108 0	0.33601	-4.73649	-8.22475
18 0	0.96804	-0.14107	-3.62933	110 0	0.33101	-4.80163	-8.28989
20 0	1.13814	0.56196	-2.92630	112 0	0.33200	-4.78863	-8.27690
22 0	1.30542	1.15750	-2.33076	114 0	0.33898	-4.69826	-8.18652
24 0	1.46601	1.66136	-1.82690	116 0	0.35186	-4.53624	-8.02451
26 0	1.61649	2.08574	-1.40252	118 0	0.37047	-4.31248	-7.80074
28 0	1.75400	2.44030	-1.04797	120 0	0.39449	-4.03960	-7.52787
30 0	1.87623	2.73286	-0.75540	122 0	0.42351	-3.73141	-7.21967
32 0	1.98148	2.96990	-0.51836	124 0	0.45692	-3.40155	-6.88981
34 0	2.06865	3.15687	-0.33139	126 0	0.49401	-3.06260	-6.55087
36 0	2.13718	3.29841	-0.18986	128 0	0.53387	-2.72563	-6.21389
38 0	2.18703	3.39854	-0.08972	130 0	0.57543	-2.40006	-5.88832
40 0	2.21860	3.46079	-0.02747	132 0	0.61748	-2.09379	-5.58205
42 0	2.23268	3.48826	0.00000	134 0	0.65865	-1.81343	-5.30170
44 0	2.23034	3.48371	-0.00455	136 0	0.69750	-1.56437	-5.05283
46 0	2.21289	3.44960	-0.03867	138 0	0.73248	-1.35201	-4.84028
48 0	2.18179	3.38814	-0.10013	140 0	0.76207	-1.18006	-4.66833
50 0	2.13861	3.30131	-0.18696	142 0	0.78475	-1.05271	-4.54098
52 0	2.08492	3.19090	-0.29737	144 0	0.79913	-0.97385	-4.46212
54 0	2.02232	3.05850	-0.42977	146 0	0.80400	-0.94745	-4.43571
56 0	1.95234	2.90555	-0.58272	148 0	0.79841	-0.97772	-4.46599
58 0	1.87643	2.73332	-0.75494	150 0	0.78175	-1.06935	-4.55761
60 0	1.79595	2.54295	-0.94532	152 0	0.75376	-1.22766	-4.71592
62 0	1.71216	2.33543	-1.15283	154 0	0.71467	-1.45893	-4.94719
64 0	1.62617	2.11165	-1.37661	156 0	0.66516	-1.77074	-5.25901
66 0	1.53899	1.87236	-1.61590	158 0	0.60639	-2.17247	-5.66073
68 0	1.45152	1.61822	-1.87004	160 0	0.54001	-2.67601	-6.16427
70 0	1.36452	1.34981	-2.13845	162 0	0.46807	-3.29687	-6.78513
72 0	1.27868	1.06762	-2.42064	164 0	0.39301	-4.05592	-7.54418
74 0	1.19457	0.77210	-2.71616	166 0	0.31752	-4.98228	-8.47055
76 0	1.11268	0.46368	-3.02458	168 0	0.24443	-6.11847	-9.61851
78 0	1.03343	0.14280	-3.34547	170 0	0.17659	-7.53025	-11.01873
80 0	0.95718	-0.19006	-3.67832	172 0	0.11674	-9.32764	-12.81591
82 0	0.88425	-0.53426	-4.02253	174 0	0.06735	-11.71678	-15.20504
84 0	0.81489	-0.88900	-4.37727	176 0	0.03048	-15.16022	-18.64849
86 0	0.74935	-1.25315	-4.74141	178 0	0.00770	-21.13377	-24.62203
88 0	0.68784	-1.62513	-5.11339	180	0.00000	-INFINITY	-INFINITY
90 0	0.63056	-2.00275	-5.49102				

TABLE A2-15

EPSLN= 3.7556E-05(NORMALIZED GROUNDPLANE RADIUS)
 MONOPOLE LENGTH= 0.250000(WAVELENGTH)
 MONOPOLE RADIUS= 0.1000E-05(WAVELENGTH)
 NUMBER OF MONOPOLE SEGMENTS= 1
 NUMBER OF DISK SEGMENTS= 1
 RADIATION RESISTANCE DETERMINED BY PATTERN= 0.473479E+02 OHMS

ELEVATION ANGLE (DEG)	DIRECTIVITY (NUMERIC)	DIRECTIVITY (DBI)	RELATIVE POWER (DB)	ELEVATION ANGLE (DEG)	DIRECTIVITY (NUMERIC)	DIRECTIVITY (DBI)	RELATIVE POWER (DB)
0	0.00000	-INFINITY	-INFINITY	92.0	0.57493	-2.40383	-6.16854
2.0	0.01708	-17.67612	-21.44083	94.0	0.52008	-2.83930	-6.60401
4.0	0.06771	-11.69375	-15.45846	96.0	0.46921	-3.28629	-7.05100
6.0	0.15012	-8.23551	-12.00022	98.0	0.42253	-3.74144	-7.50615
8.0	0.26149	-5.82547	-9.59018	100.0	0.38024	-4.19944	-7.96415
10.0	0.39803	-4.00087	-7.76558	102.0	0.34258	-4.65232	-8.41703
12.0	0.55522	-2.55535	-6.32006	104.0	0.30983	-5.08876	-8.85347
14.0	0.72802	-1.37858	-5.14329	106.0	0.28226	-5.49355	-9.25826
16.0	0.91108	-0.40445	-4.16916	108.0	0.26016	-5.84767	-9.61238
18.0	1.09899	0.40992	-3.35479	110.0	0.24381	-6.12940	-9.89411
20.0	1.28649	1.09408	-2.67063	112.0	0.23351	-6.31700	-10.08171
22.0	1.46871	1.66936	-2.09535	114.0	0.22947	-6.39274	-10.15744
24.0	1.64125	2.15174	-1.61297	116.0	0.23189	-6.34721	-10.11192
26.0	1.80037	2.55361	-1.21110	118.0	0.24086	-6.18229	-9.94700
28.0	1.94305	2.88484	-0.87987	120.0	0.25640	-5.91090	-9.67561
30.0	2.06702	3.15345	-0.61126	122.0	0.27835	-5.55412	-9.31883
32.0	2.17077	3.36615	-0.39856	124.0	0.30643	-5.13672	-8.90143
34.0	2.25351	3.52859	-0.23612	126.0	0.34016	-4.68321	-8.44792
36.0	2.31508	3.64567	-0.11904	128.0	0.37885	-4.21532	-7.98003
38.0	2.35593	3.72162	-0.04309	130.0	0.42161	-3.75091	-7.51561
40.0	2.37695	3.76019	-0.00452	132.0	0.46730	-3.30402	-7.06873
42.0	2.37942	3.76471	0.00000	134.0	0.51458	-2.88543	-6.65014
44.0	2.36490	3.73813	-0.02657	136.0	0.56191	-2.50335	-6.26806
46.0	2.33514	3.68312	-0.08159	138.0	0.60756	-2.16411	-5.92882
48.0	2.29195	3.60206	-0.16265	140.0	0.64971	-1.87281	-5.63752
50.0	2.23722	3.49708	-0.26763	142.0	0.68647	-1.63376	-5.39847
52.0	2.17275	3.37009	-0.39462	144.0	0.71600	-1.45087	-5.21558
54.0	2.10030	3.22880	-0.54191	146.0	0.73656	-1.32794	-5.09265
56.0	2.02149	3.05671	-0.70800	148.0	0.74663	-1.26894	-5.03365
58.0	1.93782	2.87314	-0.89157	150.0	0.74503	-1.27826	-5.04297
60.0	1.85064	2.67322	-1.09149	152.0	0.73098	-1.36093	-5.12564
62.0	1.76113	2.45791	-1.30680	154.0	0.70422	-1.52294	-5.28765
64.0	1.67033	2.22802	-1.53669	156.0	0.66503	-1.77159	-5.53630
66.0	1.57913	1.98418	-1.78053	158.0	0.61433	-2.11600	-5.88071
68.0	1.48829	1.72688	-2.03783	160.0	0.55362	-2.56786	-6.33257
70.0	1.39845	1.45646	-2.30825	162.0	0.48501	-3.14248	-6.90719
72.0	1.31012	1.17311	-2.59160	164.0	0.41110	-3.86057	-7.62528
74.0	1.22374	0.87688	-2.88783	166.0	0.33488	-4.75110	-8.51581
76.0	1.13965	0.56771	-3.19700	168.0	0.25963	-5.85645	-9.62116
78.0	1.05814	0.24541	-3.51930	170.0	0.18870	-7.24230	-11.00701
80.0	0.97943	-0.09028	-3.85499	172.0	0.12535	-9.01860	-12.78331
82.0	0.90371	-0.43973	-4.20444	174.0	0.07259	-11.39138	-15.15609
84.0	0.83113	-0.80331	-4.56802	176.0	0.03294	-14.82319	-18.58790
86.0	0.76184	-1.18138	-4.94609	178.0	0.00834	-20.78976	-24.55447
88.0	0.69595	-1.57420	-5.33891	180	0.00000	-INFINITY	-INFINITY
90.0	0.63361	-1.98180	-5.74651				

TABLE A2-16

EPSLN= 4 0000(NORMALIZED GROUNDPLANE RADIUS)
 MONOPOLE LENGTH= 0 250000(WAVELENGTH)
 MONOPOLE RADIUS= 0 1000E-05(WAVELENGTH)
 NUMBER OF MONOPOLE SEGMENTS= 1
 NUMBER OF DISK SEGMENTS= 16
 RADIATION RESISTANCE DETERMINED BY PATTERN= 0 444339E+02 OHMS

ELEVATION ANGLE (DEG)	DIRECTIVITY (NUMERIC)	DIRECTIVITY (DBI)	RELATIVE POWER (DB)	ELEVATION ANGLE (DEG)	DIRECTIVITY (NUMERIC)	DIRECTIVITY (DBI)	RELATIVE POWER (DB)
0	0 00000	-INFINITY	-INFINITY	92.0	0 61408	-2 11778	-6 02910
2.0	0 01922	-17 16234	-21 07366	94.0	0 55574	-2 55127	-6 46259
4.0	0 07614	-11 18380	-15 09512	96.0	0 50027	-3 00795	-6 91927
6.0	0 16858	-7 73189	-11 64321	98.0	0 44781	-3 48905	-7 40037
8.0	0 29305	-5 33064	-9 24196	100.0	0 39856	-3 99505	-7 90637
10.0	0 44492	-3 51720	-7 42852	102.0	0 35276	-4 52520	-8 43652
12.0	0 61871	-2 08513	-5 99645	104.0	0 31070	-5 07654	-8 98786
14.0	0 80836	-0 92396	-4 83528	106.0	0 27273	-5 64265	-9 55397
16.0	1 00753	0 03256	-3 87876	108.0	0 23923	-6 21179	-10 12311
18.0	1 20990	0 82748	-3 08384	110.0	0 21063	-6 76471	-10 67603
20.0	1 40947	1 49055	-2 42077	112.0	0 18739	-7 27253	-11 18385
22.0	1 60077	2 04330	-1 86802	114.0	0 16996	-7 69642	-11 60774
24.0	1 77908	2 50195	-1 40937	116.0	0 15881	-7 99120	-11 90252
26.0	1 94051	2 87916	-1 03216	118.0	0 15434	-8 11509	-12 02641
28.0	2 08212	3 18505	-0 72627	120.0	0 15691	-8 04344	-11 95477
30.0	2 20189	3 42796	-0 48336	122.0	0 16675	-7 77927	-11 69059
32.0	2 29873	3 61487	-0 29645	124.0	0 18396	-7 35270	-11 26402
34.0	2 37234	3 75178	-0 15954	126.0	0 20845	-6 80992	-10 72124
36.0	2 42318	3 84386	-0 06746	128.0	0 23991	-6 19952	-10 11084
38.0	2 45228	3 89570	-0 01563	130.0	0 27776	-5 56326	-9 47458
40.0	2 46112	3 91132	0 00000	132.0	0 32115	-4 93287	-8 84420
42.0	2 45152	3 89435	-0 01697	134.0	0 36892	-4 33063	-8 24196
44.0	2 42551	3 84803	-0 06329	136.0	0 41961	-3 77151	-7 68284
46.0	2 38521	3 77527	-0 13606	138.0	0 47148	-3 26541	-7 17673
48.0	2 33273	3 67865	-0 23267	140.0	0 52252	-2 81894	-6 73026
50.0	2 27014	3 56052	-0 35080	142.0	0 57059	-2 43679	-6 34811
52.0	2 19935	3 42294	-0 48838	144.0	0 61340	-2 12260	-6 03392
54.0	2 12213	3 26771	-0 64361	146.0	0 64870	-1 87958	-5 79090
56.0	2 04006	3 09643	-0 81489	148.0	0 67437	-1 71102	-5 62234
58.0	1 95454	2 91044	-1 00088	150.0	0 68856	-1 62057	-5 53189
60.0	1 86677	2 71090	-1 20042	152.0	0 68983	-1 61256	-5 52389
62.0	1 77776	2 49874	-1 41258	154.0	0 67727	-1 69236	-5 60369
64.0	1 68838	2 27471	-1 63661	156.0	0 65062	-1 86671	-5 77803
66.0	1 59932	2 03935	-1 87197	158.0	0 61035	-2 14424	-6 05557
68.0	1 51114	1 79305	-2 11827	160.0	0 55767	-2 53621	-6 44753
70.0	1 42429	1 53600	-2 37533	162.0	0 49459	-3 05757	-6 96889
72.0	1 33913	1 26822	-2 64310	164.0	0 42377	-3 72872	-7 64004
74.0	1 25591	0 98958	-2 92174	166.0	0 34847	-4 57837	-8 48969
76.0	1 17483	0 69975	-3 21157	168.0	0 27235	-5 64869	-9 56001
78.0	1 09604	0 39825	-3 51307	170.0	0 19929	-7 00517	-10 91649
80.0	1 01962	0 08440	-3 82692	172.0	0 13312	-8 75762	-12 66894
82.0	0 94566	-0 24263	-4 15395	174.0	0 07741	-11 11197	-15 02329
84.0	0 87420	-0 58389	-4 49521	176.0	0 03523	-14 53067	-18 44199
86.0	0 80527	-0 94058	-4 85190	178.0	0 00893	-20 48940	-24 40072
88.0	0 73891	-1 31408	-5 22540	180.	0 00000	-INFINITY	-INFINITY
90.0	0 67516	-1 70594	-5 61726				

TABLE A2-17

EPSLN= 4 (500-NORMALIZED GROUNDPLANE RADIUS)
 MONOPOLE LENGTH= 0.250000(WAVELENGTH)
 MONOPOLE RADIUS= 0.1000E-05(WAVELENGTH)
 NUMBER OF MONOPOLE SEGMENTS= 1
 NUMBER OF DISK SEGMENTS= 16
 RADIATION RESISTANCE DETERMINED BY PATTERN= 0.405777E+02 OHMS

ELEVATION ANGLE (DEG)	DIRECTIVITY (NUMERIC)	DIRECTIVITY (DBI)	RELATIVE POWER (DB)	ELEVATION ANGLE (DEG)	DIRECTIVITY (NUMERIC)	DIRECTIVITY (DBI)	RELATIVE POWER (DB)
0	0.00000	-INFINITY	-INFINITY	92.0	0.67953	-1.67794	-5.59359
2.0	0.02096	-16.78670	-20.70236	94.0	0.62146	-2.06586	-5.98152
4.0	0.08294	-10.81236	-14.72802	96.0	0.56516	-2.47829	-6.39395
6.0	0.18334	-7.36741	-11.28307	98.0	0.51069	-2.91842	-6.83407
8.0	0.31799	-4.97582	-8.89148	100.0	0.45818	-3.38965	-7.30531
10.0	0.48143	-3.17464	-7.09030	102.0	0.40780	-3.89551	-7.81117
12.0	0.66722	-1.75729	-5.67295	104.0	0.35981	-4.43932	-8.35498
14.0	0.86833	-0.61317	-4.52883	106.0	0.31451	-5.02366	-8.93932
16.0	1.07749	0.32415	-3.59151	108.0	0.27231	-5.64937	-9.56503
18.0	1.28764	1.09794	-2.81771	110.0	0.23368	-6.31385	-10.22951
20.0	1.49218	1.73820	-2.17746	112.0	0.19915	-7.00811	-10.92377
22.0	1.68528	2.26672	-1.64894	114.0	0.16935	-7.71255	-11.62791
24.0	1.86210	2.70004	-1.21562	116.0	0.14490	-8.38925	-12.30491
26.0	2.01889	3.05113	-0.86452	118.0	0.12649	-8.97939	-12.99505
28.0	2.15302	3.33049	-0.58517	120.0	0.11477	-9.40169	-13.61735
30.0	2.26298	3.54681	-0.36885	122.0	0.11034	-9.57249	-13.88815
32.0	2.34827	3.70749	-0.20817	124.0	0.11372	-9.44168	-13.35734
34.0	2.40929	3.81890	-0.09676	126.0	0.12525	-9.02234	-12.93800
36.0	2.44717	3.88664	0.02902	128.0	0.14507	-8.38413	-12.29979
38.0	2.46357	3.91566	0.00000	130.0	0.17308	-7.61759	-11.53324
40.0	2.46058	3.91038	-0.00528	132.0	0.20882	-6.80221	-10.71787
42.0	2.44049	3.87476	-0.04089	134.0	0.25151	-5.99443	-9.91008
44.0	2.40566	3.81235	-0.10331	136.0	0.29995	-5.22945	-9.14510
46.0	2.35847	3.72631	-0.18935	138.0	0.35257	-4.52757	-8.44323
48.0	2.30115	3.61944	-0.29621	140.0	0.40739	-3.89991	-7.81557
50.0	2.23575	3.49423	-0.42142	142.0	0.46212	-3.35244	-7.26810
52.0	2.16413	3.35283	-0.56282	144.0	0.51422	-2.88853	-6.80419
54.0	2.08790	3.19710	-0.71856	146.0	0.56099	-2.51041	-6.42607
56.0	2.00845	3.02860	-0.88706	148.0	0.59977	-2.22015	-6.13581
58.0	1.92692	2.84864	-1.06702	150.0	0.62804	-2.02016	-5.93581
60.0	1.84428	2.65827	-1.25739	152.0	0.64363	-1.91365	-5.82931
62.0	1.76129	2.45832	-1.45734	154.0	0.64492	-1.90497	-5.82063
64.0	1.67857	2.24941	-1.66625	156.0	0.63096	-2.00000	-5.91566
66.0	1.59660	2.03197	-1.88369	158.0	0.60164	-2.20664	-6.12230
68.0	1.51574	1.80625	-2.10941	160.0	0.55776	-2.53531	-6.45116
70.0	1.43627	1.57236	-2.34330	162.0	0.50107	-3.00104	-6.91670
72.0	1.35838	1.33022	-2.58544	164.0	0.43419	-3.62321	-7.53887
74.0	1.28222	1.07963	-2.83603	166.0	0.36055	-4.43036	-8.34602
76.0	1.20787	0.82052	-3.09544	168.0	0.28416	-5.46438	-9.38003
78.0	1.13539	0.55145	-3.36421	170.0	0.20939	-6.79050	-10.70616
80.0	1.06479	0.27263	-3.64303	172.0	0.14066	-8.51836	-12.43402
82.0	0.99606	-0.01715	-3.93281	174.0	0.08215	-10.85373	-14.76939
84.0	0.92918	-0.31899	-4.23465	176.0	0.03751	-14.25894	-18.17460
86.0	0.86412	-0.63424	-4.54989	178.0	0.00953	-20.20962	-24.12527
88.0	0.80085	-0.96450	-4.88015	180.0	0.00000	-INFINITY	-INFINITY
90.0	0.73932	-1.31166	-5.22732				

TABLE A2-18

EPSELN 4 5000(NORMALIZED GROUNDPLANE RADIUS)
 MONOPOLE LENGTH= 0 250000(WAVELENGTH)
 MONOPOLE RADIUS= 0 1000E-03(WAVELENGTH)
 NUMBER OF MONOPOLE SEGMENTS= 1
 NUMBER OF DISK SEGMENTS= 16
 RADIATION RESISTANCE DETERMINED BY PATTERN= 0 371323E+02 OHMS

ELEVATION ANGLE (DEG)	DIRECTIVITY (NUMERIC)	OIRECTIVITY (DBI)	RELATIVE POWER (DB)	ELEVATION ANGLE (DEG)	DIRECTIVITY (NUMERIC)	OIRECTIVITY (DBI)	RELATIVE POWER (DB)
0	0 00000	-INFINITY	-INFINITY	92.0	0 75173	-1 23939	-5 06911
2.0	0 02248	-16 48123	-20 31094	94.0	0 69652	-1 97066	-5 40037
4.0	0 08888	-10 51173	-14 34144	96.0	0 64224	-1 92304	-5 75275
6.0	0 19612	-7 07480	-10 90451	98.0	0 58885	-2 29999	-6 12970
8.0	0 33929	-4 69432	-8 52403	100.0	0 53635	-2 70554	-6 53525
10.0	0 51201	-2 90722	-6 73694	102.0	0 48481	-3 14433	-6 97404
12.0	0 70684	-1 50679	-5 33651	104.0	0 43435	-3 62162	-7 45133
14.0	0 91575	-0 38223	-4 21194	106.0	0 38519	-4 14325	-7 97296
16.0	1 13061	0 53313	-3 29659	108.0	0 33764	-4 71546	-8 54318
18.0	1 34364	1 28282	-2 54689	110.0	0 29211	-5 34449	-9 17420
20.0	1 54780	1 89715	-1 93256	112.0	0 24914	-6 03564	-9 86535
22.0	1 73711	2 39827	-1 43144	114.0	0 20935	-6 79136	-10 62107
24.0	1 90683	2 80313	-1 02659	116.0	0 17349	-7 60736	-11 43707
26.0	2 05358	3 12512	-0 70459	118.0	0 14239	-8 46530	-12 29501
28.0	2 17531	3 37522	-0 45450	120.0	0 11694	-9 32028	-13 14999
30.0	2 27124	3 56263	-0 26708	122.0	0 09807	-10 08465	-13 91436
32.0	2 34167	3 69527	-0 13445	124.0	0 08666	-10 62175	-14 45146
34.0	2 38783	3 78003	-0 04968	126.0	0 08352	-10 78194	-14 61165
36.0	2 41159	3 82303	-0 00668	128.0	0 08930	-10 49129	-14 32100
38.0	2 41530	3 82971	0 00000	130.0	0 10442	-9 81220	-13 64191
40.0	2 40156	3 80494	-0 02477	132.0	0 12897	-8 89514	-12 72485
42.0	2 37304	3 75306	-0 07666	134.0	0 16267	-7 88704	-11 71675
44.0	2 33233	3 67790	-0 15181	136.0	0 20477	-6 88743	-10 71715
46.0	2 28184	3 58285	-0 24686	138.0	0 25403	-5 95120	-9 78091
48.0	2 22373	3 44333	-0 35889	140.0	0 30869	-5 10473	-8 93444
50.0	2 15990	3 26543	-0 48539	142.0	0 36651	-4 35913	-8 18885
52.0	2 09191	3 05582	-0 62429	144.0	0 42479	-3 71825	-7 54797
54.0	2 02107	2 89686	-0 77389	146.0	0 48052	-3 18292	-7 01263
56.0	1 94844	2 69686	-0 93285	148.0	0 53050	-2 75318	-6 58289
58.0	1 87482	2 42959	-1 10013	150.0	0 57156	-2 42942	-6 25913
60.0	1 80085	2 15476	-1 27495	152.0	0 60076	-2 21301	-6 04272
62.0	1 72701	1 87294	-1 45677	154.0	0 61564	-2 10670	-5 93641
64.0	1 65366	1 58447	-1 64524	156.0	0 61446	-2 11504	-5 94475
66.0	1 58109	1 29856	-1 84015	158.0	0 59637	-2 24482	-6 07453
68.0	1 50949	1 07829	-2 04142	160.0	0 56160	-2 50576	-6 33548
70.0	1 43901	0 80655	-2 24907	162.0	0 51150	-2 91157	-6 74128
72.0	1 36978	0 53651	-2 46320	164.0	0 44858	-3 48158	-7 31130
74.0	1 30187	0 27568	-2 68403	166.0	0 37638	-4 24368	-8 07339
76.0	1 23534	0 091786	-2 91185	168.0	0 29927	-5 23934	-9 06905
78.0	1 17022	0 68266	-3 14705	170.0	0 22215	-6 53348	-10 36320
80.0	1 10651	0 43954	-3 39017	172.0	0 15012	-8 23549	-12 06520
82.0	1 04420	0 18782	-3 64189	174.0	0 08809	-10 55094	-14 38066
84.0	0 98325	-0 07338	-3 90310	176.0	0 04035	-13 94203	-17 77174
86.0	0 92360	-0 34517	-4 17488	178.0	0 01027	-19 88426	-23 71398
88.0	0 86518	-0 62891	-4 45862	180.	0 00000	-INFINITY	-INFINITY
90.0	0 80792	-0 92630	-4 75602				

TABLE A2-19

EPSLN= 4 500(NORMALIZED GROUNDPLANE RADIUS)
 MONOPOLE LENGTH= 0.250000(WAVELENGTH)
 MONOPOLE RADIUS= 0.1000E-05(WAVELENGTH)
 NUMBER OF MONOPOLE SEGMENTS= 1
 NUMBER OF DISK SEGMENTS= 14
 RADIATION RESISTANCE DETERMINED BY PATTERN= 0.344626E+02 OHMS

ELEVATION ANGLE (DEG)	DIRECTIVITY (NUMERIC)	DIRECTIVITY (DBI)	RELATIVE POWER (DB)	ELEVATION ANGLE (DEG)	DIRECTIVITY (NUMERIC)	DIRECTIVITY (DBI)	RELATIVE POWER (DB)
0	0.00000	-INFINITY	-INFINITY	92.0	0.81904	-0.86694	-4.54047
2.0	0.02388	-16.21896	-19.89249	94.0	0.76822	-1.14513	-4.81867
4.0	0.09430	-10.25509	-13.92862	96.0	0.71789	-1.43943	-5.11296
6.0	0.20761	-6.82747	-10.50101	98.0	0.66789	-1.75296	-5.42649
8.0	0.35811	-4.45989	-8.13343	100.0	0.61808	-2.08952	-5.76306
10.0	0.53837	-2.68916	-6.36270	102.0	0.56838	-2.43264	-6.12717
12.0	0.73988	-1.30836	-4.98189	104.0	0.51872	-2.85065	-6.52418
14.0	0.95357	-0.20646	-3.87999	106.0	0.46916	-3.28680	-6.96033
16.0	1.17044	0.68349	-2.99005	108.0	0.41982	-3.76934	-7.44287
18.0	1.38209	1.40537	-2.26816	110.0	0.37097	-4.30657	-7.98011
20.0	1.58121	1.98989	-1.68365	112.0	0.32301	-4.90788	-8.58141
22.0	1.76185	2.45968	-1.21385	114.0	0.27648	-5.58341	-9.25694
24.0	1.91964	2.83221	-0.84132	116.0	0.23210	-6.34332	-10.01686
26.0	2.05186	3.12149	-0.52005	118.0	0.19074	-7.19564	-10.86917
28.0	2.15731	3.33912	-0.33441	120.0	0.15342	-8.14117	-11.81470
30.0	2.23615	3.49502	-0.17852	122.0	0.12128	-9.16204	-12.83358
32.0	2.28970	3.59778	-0.07575	124.0	0.09553	-10.19849	-13.87202
34.0	2.32008	3.65503	-0.01851	126.0	0.07740	-11.11287	-14.78640
36.0	2.32999	3.67353	0.00000	128.0	0.06803	-11.67327	-15.34680
38.0	2.32239	3.65935	-0.01418	130.0	0.06842	-11.64825	-15.32179
40.0	2.30030	3.61784	-0.03569	132.0	0.07930	-11.00718	-14.68071
42.0	2.26659	3.55373	-0.11981	134.0	0.10102	-9.95574	-13.62927
44.0	2.22386	3.47107	-0.20247	136.0	0.13345	-8.74674	-12.42028
46.0	2.17435	3.37329	-0.30024	138.0	0.17587	-7.54799	-11.22152
48.0	2.11993	3.26321	-0.41032	140.0	0.22694	-6.44096	-10.11450
50.0	2.06207	3.14304	-0.53049	142.0	0.28462	-5.45737	-9.13090
52.0	2.00192	3.01446	-0.65907	144.0	0.34626	-4.60601	-8.27954
54.0	1.94030	2.87868	-0.79485	146.0	0.40863	-3.88666	-7.56019
56.0	1.87780	2.73649	-0.93704	148.0	0.46812	-3.29645	-6.96998
58.0	1.81484	2.58838	-1.08516	150.0	0.52089	-2.83257	-6.50610
60.0	1.75169	2.43457	-1.23896	152.0	0.56318	-2.49352	-6.16706
62.0	1.68855	2.27514	-1.39840	154.0	0.59161	-2.27964	-5.95317
64.0	1.62557	2.11005	-1.56349	156.0	0.60346	-2.19349	-5.86702
66.0	1.56287	1.93922	-1.73431	158.0	0.59700	-2.24026	-5.91380
68.0	1.50057	1.76256	-1.91097	160.0	0.57169	-2.42841	-6.10195
70.0	1.43879	1.57999	-2.09355	162.0	0.52837	-2.77062	-6.44415
72.0	1.37766	1.39142	-2.28211	164.0	0.46931	-3.28541	-6.95894
74.0	1.31729	1.19682	-2.47672	166.0	0.39811	-4.00000	-7.67353
76.0	1.25780	0.99610	-2.67743	168.0	0.31949	-4.95537	-8.62890
78.0	1.19928	0.78919	-2.88434	170.0	0.23900	-6.21603	-9.88956
80.0	1.14180	0.57591	-3.09762	172.0	0.16252	-7.89102	-11.56455
82.0	1.08542	0.35598	-3.31755	174.0	0.09581	-10.18571	-13.85924
84.0	1.03015	0.12899	-3.54455	176.0	0.04403	-13.96208	-17.23561
86.0	0.97595	-0.10573	-3.77926	178.0	0.01123	-19.49553	-23.16907
88.0	0.92277	-0.34907	-4.02260	180.0	0.00000	-INFINITY	-INFINITY
90.0	0.87051	-0.60227	-4.27580				

TABLE A2-20

EPSLN= 5 000(NORMALIZED GROUNDPLANE RADIUS)
 MONOPOLE LENGTH= 0 250000(WAVELENGTH)
 MONOPOLE RADIUS= 0 1000E-05(WAVELENGTH)
 NUMBER OF MONOPOLE SEGMENTS= 1
 NUMBER OF DISK SEGMENTS= 16
 RADIATION RESISTANCE DETERMINED BY PATTERN= 0 326839E+02 OHMS

ELEVATION ANGLE (DEG)	DIRECTIVITY (NUMERIC)	DIRECTIVITY (DBI)	RELATIVE POWER (DB)	ELEVATION ANGLE (DEG)	DIRECTIVITY (NUMERIC)	DIRECTIVITY (DBI)	RELATIVE POWER (DB)
0	0 00000	-INFINITY	-INFINITY	92 0	0 87123	-0 59866	-4 05141
2 0	0 02533	-15 96361	-19 41636	94 0	0 82541	-0 83330	-4 28606
4 0	0 09985	-10 00660	-13 45935	96 0	0 78017	-1 07812	-4 53087
6 0	0 21926	-6 59037	-10 04312	98 0	0 73523	-1 33579	-4 78854
8 0	0 37683	-4 23855	-7 69130	100 0	0 69029	-1 60966	-5 06241
10 0	0 56392	-2 48781	-5 94056	102 0	0 64508	-1 90390	-5 35665
12 0	0 77073	-1 13099	-4 58375	104 0	0 59931	-2 22349	-5 67624
14 0	0 98701	-0 05678	-3 50954	106 0	0 55279	-2 57440	-6 02715
16 0	1 20286	0 80214	-2 65061	108 0	0 50540	-2 96367	-6 41642
18 0	1 40933	1 49014	-1 96262	110 0	0 45713	-3 39959	-6 85234
20 0	1 59899	2 03845	-1 41430	112 0	0 40814	-3 89187	-7 34462
22 0	1 76620	2 47039	-0 98236	114 0	0 35877	-4 45188	-7 90463
24 0	1 90730	2 80418	-0 64857	116 0	0 30954	-5 09277	-8 54552
26 0	2 02055	3 05469	-0 39806	118 0	0 26125	-5 82948	-9 28223
28 0	2 10596	3 23450	-0 21825	120 0	0 21488	-6 67805	-10 13080
30 0	2 16497	3 35452	-0 09823	122 0	0 17167	-7 65299	-11 10574
32 0	2 20008	3 42439	-0 02836	124 0	0 13305	-8 75972	-12 21247
34 0	2 21450	3 45275	0 00000	126 0	0 10060	-9 97418	-13 42693
36 0	2 21172	3 44730	-0 00546	128 0	0 07594	-11 19539	-14 64814
38 0	2 19525	3 41483	-0 03792	130 0	0 06068	-12 16948	-15 62223
40 0	2 16834	3 36128	-0 09147	132 0	0 05626	-12 49812	-15 95087
42 0	2 13384	3 29161	-0 16114	134 0	0 06379	-11 95233	-15 40508
44 0	2 09404	3 20986	-0 24289	136 0	0 08393	-10 76061	-14 21336
46 0	2 05074	3 11911	-0 33364	138 0	0 11672	-9 32869	-12 78144
48 0	2 00519	3 02156	-0 43120	140 0	0 16142	-7 92048	-11 37323
50 0	1 95820	2 91858	-0 53417	142 0	0 21648	-6 64590	-10 09865
52 0	1 91024	2 81089	-0 64187	144 0	0 27945	-5 53698	-8 98974
54 0	1 86150	2 69863	-0 75412	146 0	0 34705	-4 59602	-8 04877
56 0	1 81200	2 58158	-0 87117	148 0	0 41531	-3 81633	-7 26908
58 0	1 76169	2 45930	-0 99345	150 0	0 47972	-3 19016	-6 64291
60 0	1 71049	2 33121	-1 12154	152 0	0 53561	-2 71148	-6 16423
62 0	1 65835	2 19677	-1 25598	154 0	0 57851	-2 37690	-5 82965
64 0	1 60529	2 05553	-1 39722	156 0	0 60450	-2 18603	-5 63878
66 0	1 55137	1 90715	-1 54560	158 0	0 61069	-2 14177	-5 59452
68 0	1 49675	1 75150	-1 70126	160 0	0 59556	-2 25077	-5 70352
70 0	1 44164	1 58858	-1 86417	162 0	0 55920	-2 52430	-5 97705
72 0	1 38630	1 41858	-2 03417	164 0	0 50352	-2 97981	-6 43257
74 0	1 33101	1 24182	-2 21093	166 0	0 43215	-3 64367	-7 09642
76 0	1 27606	1 05870	-2 39405	168 0	0 35025	-4 55617	-8 00892
78 0	1 22171	0 86968	-2 58307	170 0	0 26416	-5 78130	-9 23405
80 0	1 16821	0 67520	-2 77755	172 0	0 18081	-7 42772	-10 88047
82 0	1 11574	0 47564	-2 97711	174 0	0 10714	-9 70047	-13 15322
84 0	1 06445	0 27123	-3 18152	176 0	0 04942	-13 06132	-16 51407
86 0	1 01438	0 06202	-3 39073	178 0	0 01263	-18 98553	-22 43828
88 0	0 96555	-0 15224	-3 60499	180	0 00000	-INFINITY	-INFINITY
90 0	0 91788	-0 37213	-3 82488				

TABLE A2-21

EPSLN= 5 #500(NORMALIZED GROUNDPLANE RADIUS)
 MONOPOLE LENGTH= 0 250000(WAVELENGTH)
 MONOPOLE RADIUS= 0 1000E-05(WAVELENGTH)
 NUMBER OF MONOPOLE SEGMENTS= 1
 NUMBER OF DISK SEGMENTS= 16
 RADIATION RESISTANCE DETERMINED BY PATTERN= 0 317052E+02 OHMS

ELEVATION ANGLE (DEG)	DIRECTIVITY (NUMERIC)	DIRECTIVITY (DBI)	RELATIVE POWER (DB)	ELEVATION ANGLE (DEG)	DIRECTIVITY (NUMERIC)	DIRECTIVITY (DBI)	RELATIVE POWER (DB)
0	0 00000	-INFINITY	-INFINITY	92 0	0 90345	-0 44093	-3 60351
2 0	0 02678	-15 72116	-18 88373	94 0	0 86224	-0 64370	-3 80628
4 0	0 10538	-9 77247	-12 93504	96 0	0 82227	-0 84984	-4 01241
6 0	0 23067	-6 37000	-9 53258	98 0	0 78316	-1 06150	-4 22408
8 0	0 39470	-4 03730	-7 19987	100 0	0 74445	-1 28163	-4 44421
10 0	0 58738	-2 31081	-5 47338	102 0	0 70566	-1 51402	-4 67659
12 0	0 79742	-0 98312	-4 14569	104 0	0 66629	-1 76335	-4 92592
14 0	1 01332	0 05745	-3 10513	106 0	0 62585	-2 03530	-5 19788
16 0	1 22425	0 87869	-2 28388	108 0	0 58390	-2 33662	-5 49920
18 0	1 42088	1 52557	-1 63701	110 0	0 54010	-2 67526	-5 83783
20 0	1 59592	2 03010	-1 13247	112 0	0 49425	-3 06053	-6 22311
22 0	1 74443	2 41652	-0 74605	114 0	0 44633	-3 50341	-6 66598
24 0	1 86388	2 70419	-0 45838	116 0	0 39657	-4 01681	-7 17938
26 0	1 95401	2 90927	-0 25330	118 0	0 34546	-4 61606	-7 77864
28 0	2 01641	3 04580	-0 11678	120 0	0 29381	-5 31935	-8 48192
30 0	2 05410	3 12622	-0 03635	122 0	0 24277	-6 14797	-9 31054
32 0	2 07099	3 16178	-0 00079	124 0	0 19384	-7 12566	-10 28823
34 0	2 07137	3 16257	0 00000	126 0	0 14878	-8 27454	-11 43711
36 0	2 05947	3 13755	-0 02503	128 0	0 10964	-9 60034	-12 76292
38 0	2 03910	3 09439	-0 06818	130 0	0 07858	-11 04672	-14 20929
40 0	2 01346	3 03942	-0 12315	132 0	0 05778	-12 38202	-15 54459
42 0	1 98493	2 97746	-0 18511	134 0	0 04923	-13 07751	-16 24009
44 0	1 95516	2 91182	-0 25076	136 0	0 03454	-15 79540	-17 95400
46 0	1 92503	2 84438	-0 31819	138 0	0 02471	-18 42868	-19 79540
48 0	1 89486	2 77577	-0 38681	140 0	0 10993	-21 26611	-21 75132
50 0	1 86448	2 70559	-0 45698	142 0	0 19939	-24 58874	-24 13809
52 0	1 83347	2 63274	-0 52984	144 0	0 22113	-27 97552	-27 71616
54 0	1 80123	2 55569	-0 60688	146 0	0 29205	-31 34543	-31 50800
56 0	1 76716	2 47276	-0 68981	148 0	0 36796	-34 74201	-34 50458
58 0	1 73075	2 38234	-0 78024	150 0	0 44377	-38 16843	-38 59100
60 0	1 69162	2 28303	-0 87954	152 0	0 51384	-41 61171	-41 95429
62 0	1 64960	2 17379	-0 98879	154 0	0 57242	-45 11716	-45 58544
64 0	1 60469	2 05391	-1 10866	156 0	0 61416	-48 68423	-49 13681
66 0	1 55708	1 92311	-1 23946	158 0	0 63471	-52 31211	-52 79400
68 0	1 50712	1 78148	-1 38109	160 0	0 63121	-56 06275	-56 51684
70 0	1 45527	1 62944	-1 53314	162 0	0 60275	-59 81433	-60 36443
72 0	1 40207	1 46771	-1 69487	164 0	0 55063	-63 56939	-64 23197
74 0	1 34811	1 29725	-1 86533	166 0	0 47843	-67 33402	-68 10360
76 0	1 29396	1 11920	-2 04338	168 0	0 39180	-71 10803	-71 97402
78 0	1 24017	0 93481	-2 22777	170 0	0 29803	-74 89397	-75 76402
80 0	1 18723	0 74536	-2 41722	172 0	0 20540	-78 68402	-79 55400
82 0	1 13556	0 55210	-2 61048	174 0	0 12235	-82 48688	-83 36443
84 0	1 08546	0 35616	-2 80642	176 0	0 05664	-86 29327	-87 17938
86 0	1 03716	0 15846	-3 00411	178 0	0 01451	-90 10360	-90 97402
88 0	0 99075	-0 04037	-3 20294	180	0 00000	-INFINITY	-INFINITY
90 0	0 94622	-0 24009	-3 40266				

TABLE A2-22

EPSLN= 5 5000(NORMALIZED GROUNDPANE RADIUS)
 MONOPOLE LENGTH= 0 25000(WAVELENGTH)
 MONOPOLE RADIUS= 0 1000E-05(WAVELENGTH)
 NUMBER OF MONOPOLE SEGMENTS= 1
 NUMBER OF OISK SEGMENTS= 16
 RADIATION RESISTANCE DETERMINED BY PATTERN= 0 315339E+02 OHMS

ELEVATION ANGLE (DEG)	OIRECTIVITY (NUMERIC)	OIRECTIVITY (DBI)	RELATIVE POWER (DB)	ELEVATION ANGLE (DEG)	OIRECTIVITY (NUMERIC)	DIRECTIVITY (DBI)	RELATIVE POWER (DB)
0	0 00000	-INFINITY	-INFINITY	92.0	0 91052	-0 40711	-3 18596
2 0	0 02821	-15 49576	-18 27460	94.0	0 87253	-0 59218	-3 37103
4 0	0 11073	-9 55737	-12 33622	96.0	0 83706	-0 77243	-3 55128
6 0	0 24143	-6 17201	-8 95085	98.0	0 80364	-0 94938	-3 72823
8 0	0 41086	-3 86307	-6 64191	100.0	0 77170	-1 12552	-3 90437
10 0	0 60718	-2 16681	-4 94566	102.0	0 74057	-1 30433	-4 08318
12 0	0 81743	-0 87552	-3 65437	104.0	0 70952	-1 49036	-4 26920
14 0	1 02871	0 12291	-2 65593	106.0	0 67777	-1 68920	-4 46804
16 0	1 22939	0 89689	-1 88196	108.0	0 64453	-1 90757	-4 68642
18 0	1 41000	1 49219	-1 28665	110.0	0 60906	-2 13337	-4 93221
20 0	1 56385	1 94194	-0 83691	112.0	0 57072	-2 43574	-5 21458
22 0	1 68724	2 27176	-0 50708	114.0	0 52902	-2 76528	-5 54413
24 0	1 77942	2 50278	-0 27607	116.0	0 48369	-3 15436	-5 93321
26 0	1 84215	2 65325	-0 12559	118.0	0 43476	-3 61749	-6 39634
28 0	1 87915	2 73961	-0 03924	120.0	0 38265	-4 17197	-6 95082
30 0	1 89534	2 77688	0 00197	122.0	0 32819	-4 83873	-7 61757
32 0	1 89620	2 77885	0 00000	124.0	0 27269	-5 64327	-8 42211
34 0	1 88706	2 75785	-0 02100	126.0	0 21795	-6 61646	-9 39531
36 0	1 87261	2 72448	-0 05437	128.0	0 16621	-7 79338	-10 57222
38 0	1 85659	2 68716	-0 09169	130.0	0 12012	-9 20401	-11 98286
40 0	1 84157	2 65187	-0 12698	132.0	0 08254	-10 83354	-13 61238
42 0	1 82895	2 62201	-0 15684	134.0	0 05640	-12 48701	-15 26986
44 0	1 81908	2 59852	-0 18032	136.0	0 04444	-13 52234	-16 30119
46 0	1 81147	2 58032	-0 19853	138.0	0 04888	-13 10906	-15 88790
48 0	1 80501	2 56479	-0 21405	140.0	0 07113	-11 47939	-14 25824
50 0	1 79823	2 54846	-0 23039	142.0	0 11151	-9 52691	-12 30575
52 0	1 78958	2 52751	-0 25134	144.0	0 16894	-7 72257	-10 50142
54 0	1 77757	2 49828	-0 28037	146.0	0 24084	-6 18264	-8 96148
56 0	1 76099	2 45758	-0 32127	148.0	0 32307	-4 90708	-7 68593
58 0	1 73894	2 40285	-0 37599	150.0	0 41006	-3 87153	-6 65037
60 0	1 71092	2 33229	-0 44656	152.0	0 49520	-3 05220	-5 83104
62 0	1 67679	2 24479	-0 53405	154.0	0 57130	-2 43138	-5 21023
64 0	1 63680	2 13995	-0 63889	156.0	0 63126	-1 99791	-4 77675
66 0	1 59147	2 01798	-0 76087	158.0	0 66885	-1 74669	-4 52554
68 0	1 54156	1 87960	-0 89925	160.0	0 67944	-1 67849	-4 45734
70 0	1 48799	1 72600	-1 05285	162.0	0 66066	-1 80020	-4 57904
72 0	1 43177	1 55872	-1 22013	164.0	0 61292	-2 12595	-4 90479
74 0	1 37392	1 37962	-1 39923	166.0	0 53956	-2 67962	-5 45847
76 0	1 31546	1 19077	-1 58808	168.0	0 44672	-3 49962	-6 27847
78 0	1 25730	0 99441	-1 78444	170.0	0 34289	-4 64851	-7 42736
80 0	1 20029	0 79285	-1 98600	172.0	0 23802	-6 23383	-9 01268
82 0	1 14510	0 58842	-2 19043	174.0	0 14257	-8 45982	-11 23867
84 0	1 09229	0 38337	-2 39548	176.0	0 06626	-11 78767	-14 56651
86 0	1 04226	0 17975	-2 59910	178.0	0 01701	-17 69222	-20 47107
88 0	0 99525	-0 02068	-2 79953	180	0 00000	-INFINITY	-INFINITY
90 0	0 95136	-0 21657	-2 99541				

TABLE A2-23

EPSLN= 5 7500(NORMALIZED GROUNDPLANE RADIUS)
 MONOPOLE LENGTH= 0 250000(WAVELENGTH)
 MONOPOLE RADIUS= 0 1000E-05(WAVELENGTH)
 NUMBER OF MONOPOLE SEGMENTS= 1
 NUMBER OF DISK SEGMENTS= 16
 RADIATION RESISTANCE DETERMINED BY PATTERN= 0 322632E+02 OHMS

ELEVATION ANGLE (DEG)	DIRECTIVITY (NUMERIC)	DIRECTIVITY (DBI)	RELATIVE POWER (DB)	ELEVATION ANGLE (DEG)	DIRECTIVITY (NUMERIC)	DIRECTIVITY (DBI)	RELATIVE POWER (DB)
0	0 00000	-INFINITY	-INFINITY	92 0	0 88786	-0 51658	-3 10422
2 0	0 02945	-15 30901	-17 89665	94 0	0 85054	-0 70303	-3 29067
4 0	0 11525	-9 38361	-11 97125	96 0	0 81760	-0 87461	-3 46225
6 0	0 25004	-6 01983	-8 60747	98 0	0 78853	-1 03182	-3 61946
8 0	0 42257	-3 74099	-6 32863	100 0	0 76270	-1 17643	-3 76407
10 0	0 61899	-2 08319	-4 67083	102 0	0 73934	-1 31158	-3 89922
12 0	0 82444	-0 83842	-3 42606	104 0	0 71751	-1 44174	-4 02938
14 0	1 02469	0 10592	-2 48172	106 0	0 69619	-1 57272	-4 16036
16 0	1 20752	0 81895	-1 76869	108 0	0 67428	-1 71163	-4 29927
18 0	1 36382	1 34758	-1 24006	110 0	0 65061	-1 86679	-4 45443
20 0	1 48818	1 72654	-0 86110	112 0	0 62406	-2 04776	-4 63540
22 0	1 57896	1 98371	-0 60393	114 0	0 59356	-2 26536	-4 85300
24 0	1 63800	2 14314	-0 44450	116 0	0 55823	-2 53187	-5 11951
26 0	1 66985	2 22677	-0 36087	118 0	0 51745	-2 86130	-5 44894
28 0	1 68087	2 25534	-0 33230	120 0	0 47098	-3 26998	-5 85762
30 0	1 67822	2 24849	-0 33915	122 0	0 41906	-3 77728	-6 36492
32 0	1 66891	2 22433	-0 36331	124 0	0 36251	-4 40681	-6 99445
34 0	1 65903	2 19855	-0 38909	126 0	0 30283	-5 18808	-7 77572
36 0	1 65324	2 18336	-0 40428	128 0	0 24219	-6 15845	-8 74609
38 0	1 65445	2 18655	-0 40109	130 0	0 18346	-7 36466	-9 95230
40 0	1 66383	2 21109	-0 37655	132 0	0 13006	-8 85865	-11 44629
42 0	1 68095	2 25555	-0 33209	134 0	0 08581	-10 25289	-13 25225
44 0	1 70412	2 31501	-0 27263	136 0	0 05464	-12 62461	-15 21225
46 0	1 73079	2 38244	-0 20520	138 0	0 04024	-13 95346	-16 54110
48 0	1 75793	2 45001	-0 13763	140 0	0 04560	-13 41010	-15 99774
50 0	1 78246	2 51019	-0 07745	142 0	0 07261	-11 39002	-13 97766
52 0	1 80153	2 55642	-0 03122	144 0	0 12158	-9 15121	-11 73885
54 0	1 81280	2 58349	-0 00415	146 0	0 19095	-7 19078	-9 77842
56 0	1 81453	2 58764	0 00000	148 0	0 27705	-5 57442	-8 16206
58 0	1 80569	2 56644	-0 02120	150 0	0 37416	-4 26942	-6 85706
60 0	1 78593	2 51864	-0 06900	152 0	0 47478	-3 23504	-5 82268
62 0	1 75550	2 44400	-0 14364	154 0	0 57019	-2 43977	-5 02741
64 0	1 71518	2 34309	-0 24455	156 0	0 65124	-1 86258	-4 45022
66 0	1 66614	2 21712	-0 37052	158 0	0 70933	-1 49153	-4 07917
68 0	1 60984	2 06783	-0 51981	160 0	0 73747	-1 32255	-3 91019
70 0	1 54788	1 89738	-0 69026	162 0	0 73129	-1 35912	-3 94676
72 0	1 48193	1 70828	-0 87936	164 0	0 68977	-1 61295	-4 20059
74 0	1 41361	1 50331	-1 08433	166 0	0 61573	-2 10609	-4 69373
76 0	1 34447	1 28550	-1 30214	168 0	0 51575	-2 87563	-5 46327
78 0	1 27588	1 05810	-1 52954	170 0	0 39965	-3 98315	-6 57079
80 0	1 20906	0 82449	-1 76315	172 0	0 27955	-5 53547	-8 12311
82 0	1 14503	0 58816	-1 99948	174 0	0 16841	-7 73628	-10 32392
84 0	1 08458	0 35263	-2 23501	176 0	0 07859	-11 04640	-13 63404
86 0	1 02834	0 12135	-2 46629	178 0	0 02023	-16 94042	-19 52806
88 0	0 97669	-0 10244	-2 69008	180	0 00000	-INFINITY	-INFINITY
90 0	0 92985	-0 31586	-2 90350				

TABLE A2-24

$\epsilon_{\text{PLAN}} = 0.0000$ (NORMALIZED GROUNDPLANE RADIUS)
 MONOPOLE LENGTH = 0.25000 (WAVELENGTH)
 MONOPOLE RADIUS = 0.1000E-05 (WAVELENGTH)
 NUMBER OF MONOPOLE SEGMENTS = 1
 NUMBER OF DISK SEGMENTS = 16
 RADIATION RESISTANCE DETERMINED BY PATTERN = 0.340436E+02 OHMS

ELEVATION ANGLE (DEG)	DIRECTIVITY (NUMERIC)	DIRECTIVITY (DB)	RELATIVE POWER (DB)	ELEVATION ANGLE (DEG)	DIRECTIVITY (NUMERIC)	DIRECTIVITY (DB)	RELATIVE POWER (DB)
0	0.0000	-INFINITY	-INFINITY	92.0	0.8394	-0.7883	-3.68598
2.0	0.03020	-15.19936	-18.09671	94.0	0.79352	-1.00440	-3.90175
4.0	0.11775	-9.29050	-12.18785	96.0	0.75971	-1.19353	-4.09088
6.0	0.25384	-5.95434	-8.95169	98.0	0.73207	-1.35449	-4.25185
8.0	0.42518	-3.71423	-6.61158	100.0	0.70999	-1.48750	-4.38486
10.0	0.61571	-2.10624	-5.00360	102.0	0.69267	-1.59473	-4.49208
12.0	0.80868	-0.92223	-3.81959	104.0	0.67914	-1.68039	-4.57774
14.0	0.98873	-0.04921	-2.94657	106.0	0.66824	-1.75067	-4.64803
16.0	1.14361	0.58278	-2.31458	108.0	0.65863	-1.81357	-4.71092
18.0	1.26535	1.02212	-1.87523	110.0	0.64884	-1.87861	-4.77596
20.0	1.35083	1.30600	-1.59136	112.0	0.63729	-1.95663	-4.85399
22.0	1.40134	1.46605	-1.43131	114.0	0.62235	-2.05966	-4.95702
24.0	1.42289	1.53171	-1.36564	116.0	0.60244	-2.20083	-5.09818
26.0	1.42301	1.53208	-1.36527	118.0	0.57616	-2.39455	-5.29191
28.0	1.41137	1.49642	-1.40094	120.0	0.54239	-2.65689	-5.55425
30.0	1.39742	1.45327	-1.44408	122.0	0.50047	-3.00621	-5.90356
32.0	1.38940	1.42826	-1.46910	124.0	0.45039	-3.46416	-6.36151
34.0	1.39348	1.44102	-1.45634	126.0	0.39289	-4.05726	-6.95462
36.0	1.41333	1.50244	-1.39492	128.0	0.32967	-4.81925	-7.71660
38.0	1.44996	1.61356	-1.28380	130.0	0.26337	-5.79441	-8.69176
40.0	1.50198	1.76666	-1.13070	132.0	0.19761	-7.04181	-9.93917
42.0	1.56610	1.94819	-0.94916	134.0	0.13688	-8.63672	-11.53407
44.0	1.63768	2.14228	-0.75507	136.0	0.08619	-10.64532	-13.54268
46.0	1.71142	2.33358	-0.56378	138.0	0.05078	-12.94283	-15.84019
48.0	1.78199	2.50906	-0.38830	140.0	0.03552	-14.49485	-17.39221
50.0	1.84449	2.65876	-0.23860	142.0	0.04433	-13.53310	-16.43045
52.0	1.89485	2.77574	-0.12162	144.0	0.07951	-10.99570	-13.89305
54.0	1.93005	2.85569	-0.04167	146.0	0.14119	-8.50207	-11.39942
56.0	1.94824	2.89642	-0.00094	148.0	0.22684	-6.44287	-9.34023
58.0	1.94866	2.89735	0.00000	150.0	0.33112	-4.80015	-7.69750
60.0	1.93157	2.85910	-0.03825	152.0	0.44602	-3.50647	-6.40382
62.0	1.89807	2.78313	-0.11423	154.0	0.56137	-2.50750	-5.40486
64.0	1.84990	2.67149	-0.22587	156.0	0.66578	-1.76669	-4.66404
66.0	1.78924	2.52668	-0.37067	158.0	0.74786	-1.26181	-4.15917
68.0	1.71851	2.35152	-0.54584	160.0	0.79763	-0.98197	-3.87933
70.0	1.64023	2.14906	-0.74830	162.0	0.80798	-0.92598	-3.82334
72.0	1.55688	1.92256	-0.97479	164.0	0.77584	-1.10228	-3.99964
74.0	1.47079	1.67551	-1.22185	166.0	0.70297	-1.53064	-4.42800
76.0	1.38406	1.41156	-1.48579	168.0	0.59614	-2.24648	-5.14384
78.0	1.29857	1.13465	-1.76271	170.0	0.46664	-3.31016	-6.20751
80.0	1.21589	0.84893	-2.04843	172.0	0.32903	-4.82761	-7.72497
82.0	1.13732	0.59883	-2.33853	174.0	0.19944	-7.00189	-9.89925
84.0	1.06391	0.26904	-2.62832	176.0	0.09347	-10.29336	-13.19071
86.0	0.99643	-0.01554	-2.91290	178.0	0.02412	-16.17629	-19.0736
88.0	0.93542	-0.28992	-3.18727	180	0.00000	-INFINITY	-INFINITY
90.0	0.88122	-0.54915	-3.44650				

TABLE A2-25

$\epsilon_{\text{PSLN}} = 2500$ (NORMALIZED GROUNDPLANE RADIUS)
 MONOPOLE LENGTH= 0.250000 (WAVELENGTH)
 MONOPOLE RADIUS= 0.1000E-05 (WAVELENGTH)
 NUMBER OF MONOPOLE SEGMENTS= 1
 NUMBER OF DISK SEGMENTS= 16
 RADIATION RESISTANCE DETERMINED BY PATTERN= 0.369423E+02 OHMS

ELEVATION ANGLE (DEG)	DIRECTIVITY (NUMERIC)	DIRECTIVITY (DBI)	RELATIVE POWER (DB)	ELEVATION ANGLE (DEG)	DIRECTIVITY (NUMERIC)	DIRECTIVITY (DBI)	RELATIVE POWER (DB)
0.	0.00000	-INFINITY	-INFINITY	92.0	0.75521	-1.21934	-4.58548
2.0	0.03004	-15.22289	-18.58903	94.0	0.70726	-1.50420	-4.87034
4.0	0.11654	-9.33518	-12.70132	96.0	0.66811	-1.75153	-5.11767
6.0	0.24920	-6.03452	-9.40066	98.0	0.63745	-1.95556	-5.32170
8.0	0.41261	-3.84460	-7.21074	100.0	0.61481	-2.11259	-5.47874
10.0	0.58858	-2.30192	-5.66806	102.0	0.59954	-2.22180	-5.58794
12.0	0.75882	-1.19863	-4.56477	104.0	0.59078	-2.28572	-5.65186
14.0	0.90744	-0.42183	-3.78797	106.0	0.58744	-2.31035	-5.67649
16.0	1.02306	0.09902	-3.26712	108.0	0.58819	-2.30486	-5.67100
18.0	1.10003	0.41406	-2.95208	110.0	0.59143	-2.28100	-5.64714
20.0	1.13872	0.56418	-2.80196	112.0	0.59534	-2.25238	-5.61852
22.0	1.14494	0.58782	-2.77832	114.0	0.59788	-2.23384	-5.59998
24.0	1.12860	0.52538	-2.84076	116.0	0.59689	-2.24102	-5.60716
26.0	1.10193	0.42154	-2.94460	118.0	0.59017	-2.25020	-5.65634
28.0	1.07759	0.32453	-3.04161	120.0	0.57564	-2.39846	-5.76460
30.0	1.06687	0.28112	-3.08502	122.0	0.55154	-2.58421	-5.95035
32.0	1.07838	0.32770	-3.03844	124.0	0.51665	-2.86800	-6.23415
34.0	1.11715	0.48113	-2.88501	126.0	0.47055	-3.27392	-6.64006
36.0	1.18445	0.73517	-2.63097	128.0	0.41385	-3.83159	-7.19773
38.0	1.27795	1.06513	-2.30101	130.0	0.34838	-4.57941	-7.94555
40.0	1.39240	1.43764	-1.92850	132.0	0.27736	-5.56951	-8.93565
42.0	1.52053	1.81996	-1.54618	134.0	0.20533	-6.87539	-10.24153
44.0	1.65402	2.18542	-1.18072	136.0	0.13802	-8.60044	-11.96658
46.0	1.78443	2.51499	-0.85115	138.0	0.08197	-10.86353	-14.22967
48.0	1.90399	2.79664	-0.56950	140.0	0.04393	-13.57221	-16.93835
50.0	2.00621	3.02376	-0.34238	142.0	0.03016	-15.20591	-18.57206
52.0	2.08624	3.19364	-0.17250	144.0	0.04550	-13.42016	-16.78630
54.0	2.14099	3.30614	-0.06000	146.0	0.09251	-10.33817	-13.70431
56.0	2.16910	3.36279	-0.00335	148.0	0.17069	-7.67799	-11.04413
58.0	2.17077	3.36614	0.00000	150.0	0.27594	-5.59187	-8.95801
60.0	2.14749	3.31932	0.04682	152.0	0.40047	-3.97428	-7.34043
62.0	2.10173	3.22576	-0.14038	154.0	0.53319	-2.73121	-6.09735
64.0	2.03659	2.91274	-0.27711	156.0	0.66063	-1.80042	-5.16656
66.0	1.95357	2.51274	-0.45340	158.0	0.76845	-1.14383	-4.50997
68.0	1.86229	2.70048	-0.66566	160.0	0.84323	-0.74054	-4.10668
70.0	1.76028	2.45582	-0.91032	162.0	0.87441	-0.58287	-3.94901
72.0	1.65285	2.18233	-1.18381	164.0	0.85607	-0.67490	-4.04104
74.0	1.54298	1.88359	-1.48255	166.0	0.78824	-1.03340	-4.39954
76.0	1.43328	1.56333	-1.80282	168.0	0.67738	-1.69168	-5.05782
78.0	1.32599	1.22542	-2.14072	170.0	0.53597	-2.70859	-6.07473
80.0	1.22294	0.87405	-2.49209	172.0	0.38115	-4.18899	-7.55513
82.0	1.12559	0.51381	-2.85233	174.0	0.23253	-6.33515	-9.70129
84.0	1.03510	0.14982	-3.21632	176.0	0.10947	-9.60688	-12.97302
86.0	0.95232	-0.21219	-3.57833	178.0	0.02833	-15.47811	-18.84425
88.0	0.87785	-0.56582	-3.93196	180.	0.00000	-INFINITY	-INFINITY
90.0	0.81208	-0.90403	-4.27017				

TABLE A2-26

EPSLN= 6 5000(NORMALIZED GROUNDPLANE RADIUS)
 MONOPOLE LENGTH= 0 250000(WAVELENGTH)
 MONOPOLE RADIUS= 0 1000E-05(WAVELENGTH)
 NUMBER OF MONOPOLE SEGMENTS= 1
 NUMBER OF DISK SEGMENTS= 16
 RADIATION RESISTANCE DETERMINED BY PATTERN= 0 405661E+02 OHMS

ELEVATION ANGLE (DEG)	DIRECTIVITY (NUMERIC)	DIRECTIVITY (DBI)	RELATIVE POWER (DB)	ELEVATION ANGLE (DEG)	DIRECTIVITY (NUMERIC)	DIRECTIVITY (DBI)	RELATIVE POWER (DB)
0	0 00000	-INFINITY	-INFINITY	92 0	0 67013	-1 73840	-5 63417
2 0	0 02867	-15 42621	-19 32198	94 0	0 61098	-2 13974	-6 03551
4 0	0 11053	-9 56530	-13 46107	96 0	0 56207	-2 50209	-6 39786
6 0	0 23388	-6 31000	-10 20577	98 0	0 52330	-2 81251	-6 70828
8 0	0 38150	-4 18504	-8 08081	100 0	0 49444	-3 05886	-6 95463
10 0	0 53355	-2 72827	-6 62404	102 0	0 47514	-3 23181	-7 12798
12 0	0 67089	-1 73350	-5 65927	104 0	0 46485	-3 32690	-7 22267
14 0	0 77815	-1 08936	-4 98513	106 0	0 46281	-3 34600	-7 24177
16 0	0 84601	-0 72622	-4 62199	108 0	0 46798	-3 29775	-7 19352
18 0	0 87239	-0 59292	-4 48869	110 0	0 47900	-3 19663	-7 09240
20 0	0 86231	-0 64335	-4 53912	112 0	0 49416	-3 06129	-6 95705
22 0	0 82678	-0 82609	-4 72186	114 0	0 51138	-2 91255	-6 80832
24 0	0 78064	-1 07547	-4 97124	116 0	0 52822	-2 77184	-6 66761
26 0	0 74014	-1 30685	-5 20261	118 0	0 54197	-2 66024	-6 55601
28 0	0 72044	-1 42403	-5 31980	120 0	0 54976	-2 59825	-6 49402
30 0	0 73354	-1 34575	-5 24152	122 0	0 54876	-2 60615	-6 50192
32 0	0 78689	-1 04083	-4 93660	124 0	0 53644	-2 70482	-6 60059
34 0	0 88276	-0 54159	-4 43736	126 0	0 51086	-2 91701	-6 81278
36 0	1 01833	0 07889	-3 81688	128 0	0 47106	-3 26923	-7 16500
38 0	1 18655	0 74284	-3 15293	130 0	0 41740	-3 79443	-7 69020
40 0	1 37723	1 39006	-2 50571	132 0	0 35186	-4 53634	-8 43211
42 0	1 57851	1 98246	-1 91331	134 0	0 27819	-5 55660	-9 45237
44 0	1 77818	2 49975	-1 39602	136 0	0 20198	-6 94697	-10 84274
46 0	1 96489	2 93338	-0 96239	138 0	0 13036	-8 84851	-12 74428
48 0	2 12904	3 28184	-0 61393	140 0	0 07152	-11 45572	-15 35149
50 0	2 26336	3 54753	-0 34824	142 0	0 03386	-14 70290	-18 59867
52 0	2 36311	3 73485	-0 16092	144 0	0 02497	-16 02609	-19 92186
54 0	2 42609	3 84907	-0 04670	146 0	0 05040	-12 97553	-16 87130
56 0	2 45232	3 89577	0 00000	148 0	0 11253	-9 48734	-13 38311
58 0	2 44370	3 88047	-0 01529	150 0	0 20957	-6 78671	-10 68248
60 0	2 40352	3 80847	-0 08729	152 0	0 33507	-4 74860	-8 64437
62 0	2 33601	3 68475	-0 21102	154 0	0 47802	-3 20555	-7 10132
64 0	2 24591	3 51393	-0 38184	156 0	0 62366	-2 05054	-5 94631
66 0	2 13811	3 30030	-0 59547	158 0	0 75508	-1 22008	-5 11585
68 0	2 01735	3 04781	-0 84796	160 0	0 85540	-0 67832	-4 57409
70 0	1 88803	2 76010	-1 13567	162 0	0 91025	-0 40839	-4 30416
72 0	1 75411	2 44057	-1 45520	164 0	0 91023	-0 40848	-4 30425
74 0	1 61898	2 09242	-1 80335	166 0	0 85281	-0 69146	-4 58723
76 0	1 48550	1 71873	-2 17704	168 0	0 74337	-1 28793	-5 18370
78 0	1 35600	1 32258	-2 57319	170 0	0 59499	-2 25489	-6 15066
80 0	1 23231	0 90719	-2 98858	172 0	0 42699	-3 69586	-7 59163
82 0	1 11585	0 47607	-3 41970	174 0	0 26229	-5 81218	-9 70795
84 0	1 00769	0 03328	-3 86249	176 0	0 12408	-9 06301	-12 95878
86 0	0 90859	-0 41630	-4 31207	178 0	0 03250	-14 92186	-18 81763
88 0	0 81909	-0 86668	-4 76245	180	0 00000	-INFINITY	-INFINITY
90 0	0 73953	-1 31042	-5 20619				

TABLE A2-27

EPSLN= 6 2500(NORMALIZED GROUNDPLANE RAD[US])
 MONOPOLE LENGTH= 0 250000(WAVELENGTH)
 MONOPOLE RADIUS= 0 1000E-05(WAVELENGTH)
 NUMBER OF MONOPOLE SEGMENTS= 1
 NUMBER OF DISK SEGMENTS= 16
 RADIATION RESISTANCE DETERMINED BY PATTERN= 0 435313E+02 OHMS

ELEVATION ANGLE (DEG)	DIRECTIVITY (NUMERIC)	DIRECTIVITY (DBI)	RELATIVE POWER (DB)	ELEVATION ANGLE (DEG)	DIRECTIVITY (NUMERIC)	DIRECTIVITY (DBI)	RELATIVE POWER (DB)
0	0 00000	-INFINITY	-INFINITY	92 0	0 60775	-2 16278	-6 52695
2 0	0 02612	-15 82993	-20 19410	94 0	0 53659	-2 70357	-7 06774
4 0	0 09996	-10 00186	-14 36603	96 0	0 47578	-3 22597	-7 59014
6 0	0 20880	-6 80277	-11 16694	98 0	0 42537	-3 71230	-8 07647
8 0	0 33422	-4 75965	-9 12382	100 0	0 38544	-4 14048	-8 50465
10 0	0 45564	-3 41375	-7 77792	102 0	0 35597	-4 48585	-8 85002
12 0	0 55419	-2 56341	-6 92758	104 0	0 33689	-4 72508	-9 08925
14 0	0 61618	-2 10293	-6 46710	106 0	0 32796	-4 84177	-9 20594
16 0	0 63551	-1 96877	-6 33294	108 0	0 32871	-4 83186	-9 19603
18 0	0 61460	-2 11405	-6 47822	110 0	0 33836	-4 70620	-9 07037
20 0	0 56375	-2 48913	-6 85330	112 0	0 35574	-4 48873	-8 85290
22 0	0 49916	-3 01758	-7 38175	114 0	0 37919	-4 21143	-8 57560
24 0	0 44010	-3 56447	-7 92864	116 0	0 40656	-3 90875	-8 27292
26 0	0 40572	-3 91773	-8 28190	118 0	0 43516	-3 61353	-7 97770
28 0	0 41215	-3 84950	-8 21367	120 0	0 46183	-3 35521	-7 71938
30 0	0 47027	-3 27649	-7 64066	122 0	0 48308	-3 15984	-7 52401
32 0	0 58454	-2 33184	-6 69601	124 0	0 49532	-3 05114	-7 41531
34 0	0 75275	-1 23352	-5 59769	126 0	0 49520	-3 05222	-7 41639
36 0	0 96677	-0 14675	-4 51092	128 0	0 47999	-3 18764	-7 55181
38 0	1 21404	0 84232	-3 52185	130 0	0 44812	-3 48604	-7 85021
40 0	1 47927	1 70049	-2 66368	132 0	0 39960	-3 98380	-8 34797
42 0	1 74640	2 42143	-1 94274	134 0	0 33645	-4 73080	-8 94977
44 0	2 00018	3 01068	-1 35349	136 0	0 26300	-5 80048	-10 16465
46 0	2 22754	3 47825	-0 88592	138 0	0 18583	-7 30888	-11 67305
48 0	2 41841	3 83530	-0 52887	140 0	0 11347	-9 45115	-13 81532
50 0	2 56610	4 09274	-0 27143	142 0	0 05567	-12 54378	-16 90795
52 0	2 66730	4 26072	-0 10345	144 0	0 02228	-16 52122	-20 88539
54 0	2 72172	4 34844	-0 01573	146 0	0 02185	-16 60538	-20 96595
56 0	2 73160	4 36417	0 00000	148 0	0 06011	-12 21066	-16 57483
58 0	2 70103	4 31530	-0 04887	150 0	0 13851	-8 58529	-12 94946
60 0	2 63538	4 20842	-0 15575	152 0	0 25320	-5 96541	-10 32958
62 0	2 54063	4 04941	-0 31476	154 0	0 39466	-4 03774	-8 40191
64 0	2 42296	3 84345	-0 52072	156 0	0 54824	-2 61031	-6 97448
66 0	2 28831	3 59516	-0 76901	158 0	0 69561	-1 37635	-5 94052
68 0	2 14217	3 30855	-1 05562	160 0	0 81719	-0 87677	-5 24094
70 0	1 98937	2 98715	-1 37702	162 0	0 89509	-0 48133	-4 84550
72 0	1 83401	2 63401	-1 73016	164 0	0 91620	-0 38008	-4 74425
74 0	1 67947	2 25173	-2 11244	166 0	0 87485	-0 58067	-4 94484
76 0	1 52846	1 84255	-2 52162	168 0	0 77441	-1 11026	-5 47443
78 0	1 38306	1 40840	-2 95577	170 0	0 62755	-2 02349	-6 38766
80 0	1 24480	0 95099	-3 41318	172 0	0 45475	-3 42223	-7 78640
82 0	1 11480	0 47196	-3 89221	174 0	0 28140	-5 50670	-9 87087
84 0	0 99382	-0 02694	-4 39111	176 0	0 13380	-8 73529	-13 09946
86 0	0 88236	-0 54356	-4 90773	178 0	0 03483	-14 58098	-18 94515
88 0	0 78074	-1 07494	-5 43911	180	0 00000	-INFINITY	-INFINITY
90 0	0 68916	-1 61681	-5 98098				

TABLE A2-28

EPSLN= 7 0000(NORMALIZED GROUNDPLANE RADIUS)
 MONOPOLE LENGTH= 0.25000(WAVELENGTH)
 MONOPOLE RADIUS= 0.1000E-05(WAVELENGTH)
 NUMBER OF MONOPOLE SEGMENTS= 1
 NUMBER OF DISK SEGMENTS= 16
 RADIATION RESISTANCE DETERMINED BY PATTERN= 0.441969E+02 OHMS

ELEVATION ANGLE (DEG)	DIRECTIVITY (NUMERIC)	DIRECTIVITY (DBI)	RELATIVE POWER (DB)	ELEVATION ANGLE (DEG)	DIRECTIVITY (NUMERIC)	DIRECTIVITY (DBI)	RELATIVE POWER (DB)
0	0.00000	-INFINITY	-INFINITY	92.0	0.58973	-2.29345	-6.98661
2.0	0.02306	-16.37058	-21.06374	94.0	0.50961	-2.92761	-7.62077
4.0	0.08750	-10.58008	-15.27324	96.0	0.43849	-3.58037	-8.27353
6.0	0.18005	-7.44608	-12.13924	98.0	0.37654	-4.24189	-8.93505
8.0	0.28186	-5.49973	-10.19289	100.0	0.32400	-4.89461	-9.58777
10.0	0.37249	-4.28885	-8.98201	102.0	0.28117	-5.51025	-10.20341
12.0	0.43433	-3.62181	-8.31497	104.0	0.24842	-6.04816	-10.74132
14.0	0.45627	-3.40779	-8.10095	106.0	0.22604	-6.45810	-11.15126
16.0	0.43606	-3.60449	-8.29765	108.0	0.21425	-6.69079	-11.38395
18.0	0.38085	-4.19249	-8.88565	110.0	0.21303	-6.71551	-11.40867
20.0	0.30582	-5.14533	-9.83849	112.0	0.22206	-6.53535	-11.22851
22.0	0.23150	-6.35452	-11.04768	114.0	0.24032	-6.18841	-10.88157
24.0	0.18010	-7.44487	-12.13803	116.0	0.26707	-5.73382	-10.42698
26.0	0.17185	-7.64851	-12.34167	118.0	0.29964	-5.23402	-9.92718
28.0	0.22184	-6.53952	-11.23268	120.0	0.33548	-4.74327	-9.43643
30.0	0.33797	-4.71122	-9.40438	122.0	0.37116	-4.30437	-8.99753
32.0	0.52011	-2.83903	-7.53219	124.0	0.40269	-3.95034	-8.64350
34.0	0.76061	-1.18836	-5.88152	126.0	0.42579	-3.70805	-8.40121
36.0	1.04574	0.19423	-4.49893	128.0	0.43634	-3.60179	-8.29495
38.0	1.35779	1.32833	-3.36483	130.0	0.43083	-3.65691	-8.35007
40.0	1.67743	2.24644	-2.44672	132.0	0.40705	-3.90352	-8.59668
42.0	1.98587	2.97950	-1.71366	134.0	0.36464	-4.38131	-9.07447
44.0	2.26665	3.55385	-1.13931	136.0	0.30568	-5.14726	-9.84042
46.0	2.50686	3.99130	-0.70186	138.0	0.23498	-6.28964	-10.98280
48.0	2.69770	4.30994	-0.38322	140.0	0.16006	-7.95722	-12.65038
50.0	2.83459	4.52490	-0.16826	142.0	0.09067	-10.42542	-15.11858
52.0	2.91675	4.64899	-0.04417	144.0	0.03783	-14.22139	-18.91455
54.0	2.94656	4.69316	0.00000	146.0	0.01238	-19.07226	-23.76542
56.0	2.92879	4.66689	-0.02827	148.0	0.02319	-16.34623	-21.03939
58.0	2.86973	4.57841	-0.11475	150.0	0.07534	-11.22955	-15.92271
60.0	2.77646	4.43491	-0.25825	152.0	0.16851	-7.73365	-12.42681
62.0	2.65625	4.24268	-0.45048	154.0	0.29605	-5.28633	-9.97949
64.0	2.51605	4.00719	-0.68597	156.0	0.44498	-3.51661	-8.20977
66.0	2.36220	3.73317	-0.95999	158.0	0.59718	-2.23897	-6.93213
68.0	2.20022	3.42467	-1.26849	160.0	0.73173	-1.35651	-6.04967
70.0	2.03473	3.08507	-1.60809	162.0	0.82814	-0.81896	-5.51212
72.0	1.86946	2.71716	-1.97600	164.0	0.86999	-0.60487	-5.29803
74.0	1.70731	2.32312	-2.37004	166.0	0.84823	-0.71485	-5.40801
76.0	1.55044	1.90454	-2.78862	168.0	0.76356	-1.17154	-5.86470
78.0	1.40039	1.46248	-3.23068	170.0	0.62710	-2.02660	-6.71976
80.0	1.25819	0.99746	-3.69570	172.0	0.45921	-3.37987	-8.07303
82.0	1.12448	0.50950	-4.18366	174.0	0.28641	-5.43017	-10.12333
84.0	0.99959	-0.00178	-4.69494	176.0	0.13693	-8.63495	-13.32811
86.0	0.88367	-0.53708	-5.23024	178.0	0.03576	-14.46658	-19.15974
88.0	0.77675	-1.09719	-5.79035	180	0.00000	-INFINITY	-INFINITY
90.0	0.67878	-1.68271	-6.37587				

TABLE A2-29

EPSLN= 7.4500(NORMALIZED GROUNDPLANE RADIUS,
 MONOPOLE LENGTH= 0.250000(WAVELENGTH)
 MONOPOLE RADIUS= 0.1000E-05(WAVELENGTH)
 NUMBER OF MONOPOLE SEGMENTS= 1
 NUMBER OF DISK SEGMENTS= 16
 RADIATION RESISTANCE DETERMINED BY PATTERN= 0.422974E+02 OHMS

ELEVATION ANGLE (DEG)	DIRECTIVITY (NUMERIC)	DIRECTIVITY (DBI)	RELATIVE POWER (DB)	ELEVATION ANGLE (DEG)	DIRECTIVITY (NUMERIC)	DIRECTIVITY (DBI)	RELATIVE POWER (DB)
0	0.00000	-INFINITY	-INFINITY	92.0	0.61882	-2.08439	-6.93054
2.0	0.02033	-16.91763	-21.76379	94.0	0.53518	-2.71502	-7.56117
4.0	0.07647	-11.16526	-16.01142	96.0	0.45832	-3.38830	-8.23445
6.0	0.15495	-8.09817	-12.94432	98.0	0.38836	-4.10762	-8.95378
8.0	0.23676	-6.25324	-11.09940	100.0	0.32558	-4.87345	-9.71961
10.0	0.30282	-5.18821	-10.03436	102.0	0.27041	-5.67981	-10.52596
12.0	0.33665	-4.72824	-9.57440	104.0	0.22344	-6.50834	-11.35449
14.0	0.33024	-4.81168	-9.65784	106.0	0.18539	-7.31924	-12.16540
16.0	0.28516	-5.44911	-10.29526	108.0	0.15699	-8.04135	-12.88750
18.0	0.21274	-6.72144	-11.56759	110.0	0.13896	-8.57121	-13.41737
20.0	0.13209	-8.79132	-13.63748	112.0	0.13183	-8.79984	-13.64600
22.0	0.06654	-11.76938	-16.61554	114.0	0.13583	-8.67013	-13.51629
24.0	0.03946	-14.03870	-18.88485	116.0	0.15067	-8.21966	-13.06582
26.0	0.07023	-11.53452	-16.38068	118.0	0.17543	-7.55905	-12.40521
28.0	0.17116	-7.66586	-12.51202	120.0	0.20833	-6.81239	-11.65855
30.0	0.34577	-4.61213	-9.45828	122.0	0.24673	-6.07776	-10.92391
32.0	0.58864	-2.30148	-7.14764	124.0	0.28704	-5.42056	-10.26672
34.0	0.88667	-0.52237	-5.36853	126.0	0.32491	-4.88240	-9.72855
36.0	1.22124	0.86802	-3.97813	128.0	0.35550	-4.49165	-9.33781
38.0	1.57094	1.96160	-2.88456	130.0	0.37396	-4.27170	-9.11785
40.0	1.91422	2.81993	-2.02623	132.0	0.37611	-4.24687	-9.09303
42.0	2.23172	3.48640	-1.35976	134.0	0.35911	-4.44767	-9.29382
44.0	2.50786	3.99303	-0.85313	136.0	0.32233	-4.91699	-9.76314
46.0	2.73176	4.36443	-0.48173	138.0	0.26791	-5.72013	-10.56628
48.0	2.89746	4.62018	-0.22598	140.0	0.20117	-6.96438	-11.81054
50.0	3.00351	4.77629	-0.06987	142.0	0.13050	-8.84381	-13.68996
52.0	3.05222	4.84616	0.00000	144.0	0.06671	-11.75831	-16.60447
54.0	3.04873	4.84119	-0.00497	146.0	0.02170	-16.63487	-21.48103
56.0	2.99999	4.77120	-0.07495	148.0	0.00672	-21.72495	-26.57110
58.0	2.91390	4.64474	-0.20141	150.0	0.03019	-15.20206	-20.04821
60.0	2.79848	4.46923	-0.37693	152.0	0.09563	-10.19390	-15.04006
62.0	2.66140	4.25111	-0.59505	154.0	0.20016	-6.98623	-11.83238
64.0	2.50954	3.99595	-0.85021	156.0	0.33379	-4.76532	-9.61148
66.0	2.34882	3.70851	-1.13765	158.0	0.48011	-3.18656	-8.03271
68.0	2.18413	3.39278	-1.45338	160.0	0.61838	-2.08742	-6.93357
70.0	2.01932	3.05205	-1.79411	162.0	0.72673	-1.38625	-6.23241
72.0	1.85733	2.68888	-2.15728	164.0	0.78617	-1.04483	-5.89099
74.0	1.70028	2.30520	-2.54096	166.0	0.78451	-1.05404	-5.90020
76.0	1.54962	1.90226	-2.94390	168.0	0.71936	-1.43055	-6.27671
78.0	1.40626	1.48066	-3.36550	170.0	0.59950	-2.22213	-7.06829
80.0	1.27068	1.04035	-3.80581	172.0	0.44401	-3.32607	-8.37223
82.0	1.14303	0.58059	-4.26556	174.0	0.27929	-5.53946	-10.38562
84.0	1.02329	0.09999	-4.74617	176.0	0.13432	-8.71859	-13.56475
86.0	0.91125	-0.40361	-5.24977	178.0	0.03520	-14.53512	-19.38127
88.0	0.80667	-0.93306	-5.77922	180.0	0.00000	-INFINITY	-INFINITY
90.0	0.70926	-1.49193	-6.33808				

TABLE A2-30

EPSLN= 7 5000(NORMALIZED GROUNDPLANE RADIUS)
 MONOPOLE LENGTH= 0 250000(WAVELENGTH)
 MONOPOLE RADIUS= 0 1000E-03(WAVELENGTH)
 NUMBER OF MONOPOLE SEGMENTS= 1
 NUMBER OF DISK SEGMENTS= 16
 RADIATION RESISTANCE DETERMINED BY PATTERN= 0 391003E+02 OHMS

ELEVATION ANGLE (DEG)	DIRECTIVITY (NUMERIC)	DIRECTIVITY (DBI)	RELATIVE POWER (DB)	ELEVATION ANGLE (DEG)	DIRECTIVITY (NUMERIC)	DIRECTIVITY (DBI)	RELATIVE POWER (DB)
0	0 00000	-INFINITY	-INFINITY	92.0	0 68087	-1 66937	-6 52933
2.0	0 01853	-17 32209	-22 18205	94.0	0 59916	-2 22460	-7 08437
4.0	0 06915	-11 60200	-16 46196	96.0	0 52191	-2 82400	-7 68397
6.0	0 13830	-8 59176	-13 45173	98.0	0 44909	-3 47663	-8 33659
8.0	0 20731	-6 83376	-11 69372	100.0	0 38083	-4 19272	-9 05269
10.0	0 25730	-5 89555	-10 75551	102.0	0 31746	-4 98308	-9 84304
12.0	0 27414	-5 62029	-10 48025	104.0	0 25958	-5 85728	-10 71724
14.0	0 25228	-5 98118	-10 84115	106.0	0 20799	-6 81953	-11 67950
16.0	0 19660	-7 06426	-11 92423	108.0	0 16371	-7 85920	-12 71917
18.0	0 12180	-9 14346	-14 00342	110.0	0 12790	-8 93134	-13 79131
20.0	0 04971	-13 03524	-17 89521	112.0	0 10176	-9 92433	-14 78430
22.0	0 00506	-22 96253	-27 82249	114.0	0 08640	-10 63504	-15 49500
24.0	0 01080	-19 66616	-24 52612	116.0	0 08264	-10 82807	-15 68803
26.0	0 08403	-10 75546	-15 61543	118.0	0 09081	-10 41853	-15 27849
28.0	0 23314	-6 32382	-11 18378	120.0	0 11050	-9 56631	-14 42627
30.0	0 45669	-3 40379	-8 26375	122.0	0 14034	-8 52807	-13 38804
32.0	0 74406	-1 28393	-6 14389	124.0	0 17787	-7 49904	-12 35900
34.0	1 07745	0 32399	-4 53597	126.0	0 21945	-6 58665	-11 44661
36.0	1 43478	1 56785	-3 29211	128.0	0 26044	-5 84297	-10 70293
38.0	1 79274	2 53516	-2 32480	130.0	0 29548	-5 29476	-10 15473
40.0	2 12965	3 28307	-1 57689	132.0	0 31908	-4 96102	-9 82099
42.0	2 42758	3 85173	-1 00823	134.0	0 32639	-4 86268	-9 72264
44.0	2 67363	4 27101	-0 58895	136.0	0 31409	-5 02942	-9 88938
46.0	2 86035	4 56419	-0 29577	138.0	0 28136	-5 50741	-10 36737
48.0	2 98543	4 75007	-0 10990	140.0	0 23056	-6 37225	-11 23221
50.0	3 05087	4 84424	-0 01572	142.0	0 16764	-7 75635	-12 61631
52.0	3 06194	4 85996	0 00000	144.0	0 10190	-9 91820	-14 77816
54.0	3 02596	4 80863	-0 05134	146.0	0 04508	-13 46042	-18 32038
56.0	2 95128	4 70011	-0 15986	148.0	0 00965	-20 15405	-25 01401
58.0	2 84642	4 54298	-0 31698	150.0	0 00667	-21 76071	-26 62067
60.0	2 71938	4 34469	-0 51527	152.0	0 04330	-13 63556	-18 49553
62.0	2 57728	4 11162	-0 74834	154.0	0 12069	-9 18339	-14 04335
64.0	2 42616	3 84920	-1 01076	156.0	0 23264	-6 33310	-11 19307
66.0	2 27090	3 56198	-1 29798	158.0	0 36559	-4 37001	-9 22997
68.0	2 11528	3 25367	-1 60629	160.0	0 50016	-3 00893	-7 86889
70.0	1 96211	2 92724	-1 93272	162.0	0 61421	-2 11686	-6 97682
72.0	1 81340	2 58494	-2 27503	164.0	0 70700	-1 63045	-6 49041
74.0	1 67046	2 22837	-2 63159	166.0	0 78358	-1 52688	-6 38685
76.0	1 53409	1 85852	-3 00144	168.0	0 69845	-1 81475	-6 67472
78.0	1 40468	1 47578	-3 38418	170.0	0 55760	-2 53680	-7 39677
80.0	1 28231	1 07993	-3 78003	172.0	0 41811	-3 78707	-8 64704
82.0	1 16685	0 67014	-4 18982	174.0	0 26543	-5 76050	-10 62047
84.0	1 05801	0 24490	-4 61507	176.0	0 12847	-8 91196	-13 77193
86.0	0 95542	-0 19807	-5 05804	178.0	0 03379	-14 71221	-19 57217
88.0	0 85864	-0 66188	-5 52184	180	0 00000	-INFINITY	-INFINITY
90.0	0 76726	-1 15059	-6 01055				

TABLE A2-31

EPSLN= 7.7500E-06 NORMALIZED GROUNDPLANE RADIUS
 MONOPOLE LENGTH= 0.250000(WAVELENGTH)
 MONOPOLE RADIUS= 0.1000E-05(WAVELENGTH)
 NUMBER OF MONOPOLE SEGMENTS= 1
 NUMBER OF DISK SEGMENTS= 16
 RADIATION RESISTANCE DETERMINED BY PATTERN= 0.359610E+02 OHMS

ELEVATION ANGLE (DEG)	DIRECTIVITY (NUMERIC)	DIRECTIVITY (DBI)	RELATIVE POWER (DB)	ELEVATION ANGLE (DEG)	DIRECTIVITY (NUMERIC)	DIRECTIVITY (DBI)	RELATIVE POWER (DB)
0	0.00000	-INFINITY	-INFINITY	92.0	0.75517	-1.21953	-5.97906
2.0	0.01784	-17.48706	-22.24659	94.0	0.67926	-1.67962	-6.43915
4.0	0.06625	-11.78837	-16.54789	96.0	0.60609	-2.17460	-6.93413
6.0	0.13136	-8.81524	-13.57477	98.0	0.53537	-2.71350	-7.47303
8.0	0.19442	-7.11251	-11.87204	100.0	0.46593	-3.30745	-8.06697
10.0	0.23703	-6.25193	-11.01146	102.0	0.40086	-3.97003	-8.72955
12.0	0.24640	-6.08351	-10.84304	104.0	0.33748	-4.71754	-9.47707
14.0	0.21920	-6.59151	-11.35104	106.0	0.27740	-5.56900	-10.32853
16.0	0.16301	-7.87779	-12.63732	108.0	0.22155	-6.54521	-11.30474
18.0	0.09515	-10.21591	-14.97544	110.0	0.17120	-7.66496	-12.42449
20.0	0.03921	-14.06578	-18.82531	112.0	0.12785	-8.93307	-13.69260
22.0	0.02026	-16.93328	-21.69280	114.0	0.09317	-10.30714	-15.06667
24.0	0.05983	-12.23063	-16.99016	116.0	0.06885	-11.62068	-16.38021
26.0	0.17186	-7.64820	-12.40773	118.0	0.05636	-12.49043	-17.24996
28.0	0.36032	-4.43317	-9.19270	120.0	0.05665	-12.46764	-17.22717
30.0	0.61881	-2.08440	-6.84393	122.0	0.06992	-11.55413	-16.31366
32.0	0.93210	-0.30536	-5.06489	124.0	0.09523	-10.21247	-14.97200
34.0	1.27884	1.06817	-3.69136	126.0	0.13033	-8.84953	-13.60906
36.0	1.63500	2.13518	-2.62434	128.0	0.17156	-7.65972	-12.41525
38.0	1.97721	2.96052	-1.79901	130.0	0.21395	-6.69692	-11.45645
40.0	2.28542	3.58967	-1.16986	132.0	0.25157	-5.99340	-10.75293
42.0	2.54474	4.05644	-0.70309	134.0	0.27826	-5.55542	-10.31495
44.0	2.74611	4.38718	-0.37235	136.0	0.28854	-5.39799	-10.15752
46.0	2.88616	4.60320	-0.15633	138.0	0.27867	-5.54905	-10.30858
48.0	2.96638	4.72227	-0.03725	140.0	0.24782	-6.05866	-10.81819
50.0	2.99194	4.75953	0.00000	142.0	0.19881	-7.01560	-11.77513
52.0	2.97030	4.72800	-0.03153	144.0	0.13848	-8.58600	-13.34553
54.0	2.91005	4.63900	-0.12053	146.0	0.07723	-11.12196	-15.88149
56.0	2.81987	4.50230	-0.25723	148.0	0.02770	-15.57486	-20.33439
58.0	2.70787	4.32628	-0.43325	150.0	0.00267	-25.72946	-30.48899
60.0	2.58110	4.11806	-0.64147	152.0	0.01243	-19.05387	-23.81340
62.0	2.44542	3.88354	-0.87599	154.0	0.06212	-12.06758	-16.82711
64.0	2.30545	3.62756	-1.13197	156.0	0.14588	-8.24840	-13.00793
66.0	2.16469	3.35395	-1.40558	158.0	0.26505	-5.76666	-10.52619
68.0	2.02568	3.06571	-1.69382	160.0	0.39109	-4.07721	-8.83674
70.0	1.89021	2.76509	-1.99443	162.0	0.50423	-2.95655	-7.71608
72.0	1.75945	2.45376	-2.30577	164.0	0.58861	-2.30175	-7.06128
74.0	1.63412	2.13284	-2.62669	166.0	0.62088	-2.06995	-6.82948
76.0	1.51462	1.80303	-2.95649	168.0	0.59449	-2.25855	-7.01808
78.0	1.40108	1.46464	-3.29489	170.0	0.51244	-2.90359	-7.66311
80.0	1.29347	1.11755	-3.64198	172.0	0.38950	-4.09488	-8.85441
82.0	1.19158	0.76123	-3.99830	174.0	0.24977	-6.02465	-10.78418
84.0	1.09513	0.39465	-4.36488	176.0	0.12173	-9.14600	-13.90553
86.0	1.00372	0.01614	-4.74339	178.0	0.03215	-14.92858	-19.68811
88.0	0.91692	-0.37668	-5.13621	180	0.00000	-INFINITY	-INFINITY
90.0	0.83424	-0.78711	-5.54664				

TABLE A2-32

EPSLN= 8.0000(NORMALIZED GROUNDPLANE RADIUS)
 MONOPOLE LENGTH= 0.250000(WAVELENGTH)
 MONOPOLE RADIUS= 0.1000E-05(WAVELENGTH)
 NUMBER OF MONOPOLE SEGMENTS= 1
 NUMBER OF DISK SEGMENTS= 16
 RADIATION RESISTANCE DETERMINED BY PATTERN= 0.334954E+02 OHMS

ELEVATION ANGLE (DEG)	DIRECTIVITY (NUMERIC)	DIRECTIVITY (DBI)	RELATIVE POWER (DB)	ELEVATION ANGLE (DEG)	DIRECTIVITY (NUMERIC)	DIRECTIVITY (DBI)	RELATIVE POWER (DB)
0.	0.00000	-INFINITY	-INFINITY	92.0	0.82468	-0.83717	-5.40269
2.0	0.01822	-17.39420	-21.95972	94.0	0.75628	-1.21315	-5.77867
4.0	0.06752	-11.70576	-16.27128	96.0	0.68987	-1.61231	-6.17783
6.0	0.13338	-8.74916	-13.31468	98.0	0.62486	-2.04215	-6.60767
8.0	0.19643	-7.06787	-11.63338	100.0	0.56076	-2.51222	-7.07774
10.0	0.23822	-6.23020	-10.79572	102.0	0.49722	-3.03454	-7.60006
12.0	0.24677	-6.07715	-10.64267	104.0	0.43411	-3.62403	-8.18935
14.0	0.22042	-6.56744	-11.13296	106.0	0.37160	-4.29919	-8.86470
16.0	0.16999	-7.72144	-12.28695	108.0	0.31025	-5.08284	-9.64835
18.0	0.11186	-9.51318	-14.07870	110.0	0.25102	-6.00297	-10.56849
20.0	0.07383	-11.31738	-15.88390	112.0	0.19530	-7.09293	-11.65845
22.0	0.07968	-10.98636	-15.55188	114.0	0.14493	-8.38846	-12.95398
24.0	0.14892	-8.27038	-12.83590	116.0	0.10203	-9.91258	-14.47810
26.0	0.29194	-5.34707	-9.91259	118.0	0.06889	-11.61826	-16.18378
28.0	0.50820	-2.93963	-7.50515	120.0	0.04766	-13.21859	-17.78411
30.0	0.78675	-1.04166	-5.60718	122.0	0.04001	-13.97816	-18.54368
32.0	1.10851	0.44741	-4.11811	124.0	0.04676	-13.30092	-17.86643
34.0	1.44987	1.61328	-2.95224	126.0	0.06746	-11.70953	-16.27505
36.0	1.78637	2.51972	-2.04580	128.0	0.10005	-9.99765	-14.56317
38.0	2.09616	3.21424	-1.35128	130.0	0.14075	-8.51544	-13.08096
40.0	2.36227	3.73329	-0.83223	132.0	0.18413	-7.34885	-11.91437
42.0	2.57388	4.10589	-0.45963	134.0	0.23356	-6.90598	-11.07149
44.0	2.72638	4.35986	-0.20966	136.0	0.25211	-5.98417	-10.54968
46.0	2.82053	4.50331	-0.06220	138.0	0.26359	-5.79068	-10.35620
48.0	2.86122	4.56552	0.00000	140.0	0.25400	-5.93170	-10.51722
50.0	2.85590	4.55743	-0.00809	142.0	0.22270	-6.52277	-11.08829
52.0	2.81318	4.49198	-0.07354	144.0	0.17336	-7.61049	-12.17800
54.0	2.74174	4.38026	-0.18526	146.0	0.11409	-9.42763	-13.99315
56.0	2.64947	4.23159	-0.33393	148.0	0.05665	-12.46805	-17.03357
58.0	2.54309	4.05361	-0.51191	150.0	0.01465	-18.34132	-22.90684
60.0	2.42795	3.85239	-0.71312	152.0	0.00086	-30.67217	-35.23769
62.0	2.30813	3.63261	-0.93591	154.0	0.02413	-16.17406	-20.73958
64.0	2.18660	3.39769	-1.16783	156.0	0.08669	-10.62006	-15.18358
66.0	2.06544	3.15012	-1.41540	158.0	0.18245	-7.38849	-11.95401
68.0	1.94608	2.89160	-1.67392	160.0	0.29709	-5.27114	-9.83666
70.0	1.82951	2.62336	-1.94216	162.0	0.41020	-3.87004	-8.43556
72.0	1.71643	2.34626	-2.21926	164.0	0.49929	-3.01644	-7.58196
74.0	1.60731	2.06099	-2.50452	166.0	0.54486	-2.63714	-7.20266
76.0	1.50250	1.76814	-2.79738	168.0	0.53535	-2.71361	-7.27913
78.0	1.40223	1.46818	-3.09733	170.0	0.47068	-3.27278	-7.83830
80.0	1.30663	1.16153	-3.40399	172.0	0.36317	-4.39893	-8.96445
82.0	1.21573	0.84837	-3.71714	174.0	0.23546	-6.28080	-10.84631
84.0	1.12944	0.52864	-4.03688	176.0	0.11563	-9.36926	-13.93478
86.0	1.04756	0.20179	-4.36372	178.0	0.03067	-15.13261	-19.69813
88.0	0.96977	-0.13331	-4.69883	180.	0.00000	-INFINITY	-INFINITY
90.0	0.89565	-0.47863	-5.04415				

TABLE A2-33

EPSLN= 8 $\sqrt{500}$ (NORMALIZED GROUNDPLANE RADIUS)
 MONOPOLE LENGTH= 0.250000(WAVELENGTH)
 MONOPOLE RADIUS= 0.1000E-05(WAVELENGTH)
 NUMBER OF MONOPOLE SEGMENTS= 1
 NUMBER OF DISK SEGMENTS= 16
 RADIATION RESISTANCE DETERMINED BY PATTERN= 0.318841E+02 OHMS

ELEVATION ANGLE (DEG)	DIRECTIVITY (NUMERIC)	DIRECTIVITY (DBI)	RELATIVE POWER (DB)	ELEVATION ANGLE (DEG)	DIRECTIVITY (NUMERIC)	DIRECTIVITY (DBI)	RELATIVE POWER (DB)
0	0.00000	-INFINITY	-INFINITY	92.0	0.87662	-0.57187	-4.87768
2.0	0.01951	-17.09849	-21.40430	94.0	0.81544	-0.88608	-5.19189
4.0	0.07222	-11.41326	-15.71906	96.0	0.75661	-1.21126	-5.51707
6.0	0.14255	-8.46026	-12.76606	98.0	0.69532	-1.55326	-5.85907
8.0	0.20992	-6.77947	-11.08528	100.0	0.64269	-1.91996	-6.22577
10.0	0.25316	-5.93182	-10.23763	102.0	0.58594	-2.32150	-6.62731
12.0	0.26656	-5.74202	-10.04783	104.0	0.52836	-2.77069	-7.07650
14.0	0.24374	-6.13081	-10.43662	106.0	0.46953	-3.28339	-7.58920
16.0	0.19837	-7.02533	-11.33114	108.0	0.40933	-3.87925	-8.18506
18.0	0.15163	-8.19216	-12.49797	110.0	0.34812	-4.58267	-8.88848
20.0	0.12919	-8.88770	-13.19351	112.0	0.28680	-5.42425	-9.73006
22.0	0.10519	-8.09141	-12.39722	114.0	0.22685	-6.44259	-10.74840
24.0	0.07482	-6.07612	-10.38193	116.0	0.17038	-7.68571	-11.99152
26.0	0.41080	-3.86369	-8.16950	118.0	0.12001	-9.20786	-13.51367
28.0	0.64228	-1.92276	-6.22856	120.0	0.07865	-11.04288	-15.34869
30.0	0.92630	-0.33246	-4.63827	122.0	0.04923	-13.07732	-17.38313
32.0	1.24104	0.93786	-3.36795	124.0	0.03423	-14.65581	-18.96162
34.0	1.56190	1.93654	-2.36926	126.0	0.03516	-14.54011	-18.84592
36.0	1.86556	2.70809	-1.59772	128.0	0.05203	-12.83783	-17.14364
38.0	2.13304	3.29000	-1.01581	130.0	0.08293	-10.81305	-15.11886
40.0	2.35160	3.71364	-0.59217	132.0	0.12379	-9.07317	-13.37898
42.0	2.51511	4.00558	-0.30023	134.0	0.16852	-7.73348	-12.03929
44.0	2.62344	4.18872	-0.11709	136.0	0.20958	-6.78642	-11.09223
46.0	2.68102	4.28301	-0.02280	138.0	0.23906	-6.21490	-10.52071
48.0	2.69514	4.30581	0.00000	140.0	0.25010	-6.01885	-10.32466
50.0	2.67430	4.27209	-0.03372	142.0	0.23854	-6.22438	-10.53019
52.0	2.62691	4.19445	-0.11136	144.0	0.20436	-6.89597	-11.20178
54.0	2.56041	4.08309	-0.22272	146.0	0.15256	-8.16554	-12.47135
56.0	2.48079	3.94590	-0.35991	148.0	0.09303	-10.31400	-14.61981
58.0	2.39255	3.78861	-0.51720	150.0	0.03920	-14.06663	-18.37244
60.0	2.29882	3.61505	-0.69076	152.0	0.00560	-22.52162	-26.82743
62.0	2.20167	3.42753	-0.87828	154.0	0.00441	-23.55649	-27.86230
64.0	2.10246	3.22727	-1.07854	156.0	0.04216	-13.75131	-18.05712
66.0	2.00207	3.01480	-1.29101	158.0	0.11706	-9.31583	-13.62164
68.0	1.90123	2.79035	-1.51546	160.0	0.21819	-6.61167	-10.91748
70.0	1.80058	2.55413	-1.75168	162.0	0.32886	-4.85642	-8.16222
72.0	1.70079	2.30651	-1.99930	164.0	0.42035	-3.76394	-6.06975
74.0	1.60295	2.04812	-2.25769	166.0	0.47719	-3.21305	-5.18866
76.0	1.50659	1.77994	-2.52587	168.0	0.48284	-3.16194	-4.67775
78.0	1.41357	1.50318	-2.80262	170.0	0.43402	-3.62492	-7.93073
80.0	1.32412	1.21927	-3.08654	172.0	0.34049	-4.67891	-8.98471
82.0	1.23870	0.92966	-3.37615	174.0	0.22345	-6.50812	-10.81392
84.0	1.15764	0.63572	-3.67009	176.0	0.11065	-9.56063	-13.86643
86.0	1.08106	0.33850	-3.96731	178.0	0.02949	-15.30301	-19.60882
88.0	1.00890	0.03850	-4.26731	180.0	0.00000	-INFINITY	-INFINITY
90.0	0.94091	-0.26453	-4.57034				

TABLE A2-34

EPSLN= 8.5600(NORMALIZED GROUNDPLANE RADIUS)
 MONOPOLE LENGTH= 0.25000(WAVELENGTH)
 MONOPOLE RADIUS= 0.1000E-05(WAVELENGTH)
 NUMBER OF MONOPOLE SEGMENTS= 1
 NUMBER OF DISK SEGMENTS= 16
 RADIATION RESISTANCE DETERMINED BY PATTERN= 0.311644E+02 OHMS

ELEVATION ANGLE (DEG)	DIRECTIVITY (NUMERIC)	DIRECTIVITY (DBI)	RELATIVE POWER (DB)	ELEVATION ANGLE (DEG)	DIRECTIVITY (NUMERIC)	DIRECTIVITY (DBI)	RELATIVE POWER (DB)
0.	0.00000	-INFINITY	-INFINITY	92.0	0.90179	-0.44893	-4.42238
2.0	0.02145	-16.68529	-20.65873	94.0	0.84562	-0.72826	-4.70170
4.0	0.07941	-11.00120	-14.97465	96.0	0.79330	-1.00560	-4.97903
6.0	0.15674	-8.04830	-12.02175	98.0	0.74385	-1.28517	-5.25842
8.0	0.23104	-6.36307	-10.33652	100.0	0.69609	-1.57334	-5.54679
10.0	0.28187	-5.49946	-9.47291	102.0	0.64881	-1.87883	-5.85228
12.0	0.29729	-5.26823	-9.24168	104.0	0.60077	-2.21295	-6.18640
14.0	0.27786	-5.56175	-9.53519	106.0	0.55084	-2.58978	-6.56322
16.0	0.23696	-6.25330	-10.22675	108.0	0.49813	-3.02654	-6.99999
18.0	0.19737	-7.04715	-11.02060	110.0	0.44216	-3.54423	-7.51768
20.0	0.18545	-7.31784	-11.29128	112.0	0.38295	-4.16860	-8.14205
22.0	0.22447	-6.48844	-10.46189	114.0	0.32124	-4.93174	-8.90519
24.0	0.32918	-4.82571	-8.79916	116.0	0.25856	-5.87443	-9.84788
26.0	0.50266	-2.98728	-6.96073	118.0	0.19728	-7.04927	-11.02272
28.0	0.73619	-1.33009	-5.30354	120.0	0.14052	-8.52265	-12.49610
30.0	1.01169	0.05048	-3.92297	122.0	0.09195	-10.36455	-14.33800
32.0	1.30581	1.15880	-2.81464	124.0	0.05536	-12.56775	-16.54120
34.0	1.59453	2.02634	-1.94711	126.0	0.03414	-14.66738	-18.64083
36.0	1.85714	2.68845	-1.28500	128.0	0.03055	-15.14986	-19.12331
38.0	2.07886	3.17826	-0.79519	130.0	0.04506	-13.46181	-17.43526
40.0	2.25189	3.52547	-0.44798	132.0	0.07576	-11.20554	-15.17899
42.0	2.37495	3.75655	-0.21690	134.0	0.11806	-9.27891	-13.25236
44.0	2.45189	3.89500	-0.07845	136.0	0.16491	-7.82760	-11.80105
46.0	2.48968	3.96144	-0.01201	138.0	0.20755	-6.82870	-10.80215
48.0	2.49458	3.97345	0.00000	140.0	0.23696	-6.25320	-10.22665
50.0	2.48050	3.94540	-0.02805	142.0	0.24565	-6.09688	-10.07033
52.0	2.44807	3.88824	-0.08321	144.0	0.22964	-6.38952	-10.36297
54.0	2.40414	3.80960	-0.16385	146.0	0.19010	-7.21019	-11.18364
56.0	2.35180	3.71400	-0.25945	148.0	0.13402	-8.72815	-12.70160
58.0	2.29270	3.60347	-0.36998	150.0	0.07364	-11.32915	-15.30280
60.0	2.22754	3.47825	-0.49520	152.0	0.02424	-16.15425	-20.12770
62.0	2.15650	3.33749	-0.63996	154.0	0.00085	-30.70211	-34.67556
64.0	2.07966	3.17992	-0.79353	156.0	0.01416	-18.48817	-22.46162
66.0	1.99728	3.00438	-0.96907	158.0	0.06703	-11.73701	-15.71046
68.0	1.90993	2.81017	-1.16328	160.0	0.15249	-8.16760	-12.14105
70.0	1.81853	2.59719	-1.37626	162.0	0.25421	-5.94805	-9.92149
72.0	1.72428	2.36608	-1.60737	164.0	0.34976	-4.56231	-8.53576
74.0	1.62861	2.11816	-1.85529	166.0	0.41599	-3.80922	-7.78267
76.0	1.53298	1.85538	-2.11807	168.0	0.43533	-3.61181	-7.58526
78.0	1.43887	1.58022	-2.39323	170.0	0.40119	-3.96654	-7.93999
80.0	1.34758	1.26779	-2.67791	172.0	0.32060	-4.94036	-8.91381
82.0	1.26022	1.00445	-2.96900	174.0	0.21323	-6.71161	-10.68506
84.0	1.17763	0.71009	-3.26336	176.0	0.10654	-9.72478	-13.69823
86.0	1.10038	0.41543	-3.55802	178.0	0.02855	-15.44433	-19.41778
88.0	1.02873	0.12300	-3.85045	180	0.00000	-INFINITY	-INFINITY
90.0	0.96264	-0.16537	-4.13882				

TABLE A2-35

EPSLN= 8 5000(NORMALIZED GROUNDPLANE RADIUS)
 MONOPOLE LENGTH= 0 230000(WAVELENGTH)
 MONOPOLE RADIUS= 0 1000E-05(WAVELENGTH)
 NUMBER OF MONOPOLE SEGMENTS= 1
 NUMBER OF DISK SEGMENTS= 25
 NUMBER OF ANNULAR ZONES PER DISK SEGMENT= 1
 RADIATION RESISTANCE DETERMINED BY PATTERN= 0 315105E+02 OHMS

ELEVATION ANGLE (DEG)	DIRECTIVITY (NUMERIC)	DIRECTIVITY (dBi)	RELATIVE POWER (dB)	ELEVATION ANGLE (DEG)	DIRECTIVITY (NUMERIC)	DIRECTIVITY (dBi)	RELATIVE POWER (dB)
0.	0.00000	-INFINITY	-INFINITY	92.0	0.89041	-0.50412	-4.48282
2.0	0.02167	-16.64156	-20.62027	94.0	0.83372	-0.78980	-4.76850
4.0	0.08021	-10.95788	-14.93659	96.0	0.78119	-1.07242	-5.03112
6.0	0.15828	-8.00572	-11.98442	98.0	0.73181	-1.35600	-5.33470
8.0	0.23326	-6.32167	-10.30037	100.0	0.68441	-1.64684	-5.62555
10.0	0.28445	-5.45988	-9.43859	102.0	0.63772	-1.93241	-5.93241
12.0	0.29981	-5.23156	-9.21027	104.0	0.59047	-2.28799	-6.26669
14.0	0.27991	-5.52989	-9.50859	106.0	0.54151	-2.66394	-6.64265
16.0	0.23825	-6.22962	-10.20833	108.0	0.48989	-3.09905	-7.07775
18.0	0.19786	-7.03632	-11.01502	110.0	0.43505	-3.61456	-7.59326
20.0	0.18532	-7.32088	-11.29958	112.0	0.37701	-4.23651	-8.21521
22.0	0.22407	-6.49615	-10.47486	114.0	0.31643	-4.99718	-8.97589
24.0	0.32893	-4.82895	-8.80766	116.0	0.25483	-5.93742	-9.91613
26.0	0.50293	-2.98489	-6.96359	118.0	0.19457	-7.10933	-11.08803
28.0	0.73721	-1.32407	-5.30277	120.0	0.13876	-8.57722	-12.55593
30.0	1.01349	0.05819	-3.92051	122.0	0.09112	-10.40385	-14.38255
32.0	1.30823	1.16485	-2.81185	124.0	0.05548	-12.55835	-16.53705
34.0	1.59731	2.03389	-1.94481	126.0	0.03529	-14.52323	-18.50193
36.0	1.85998	2.69507	-1.28363	130.0	0.04876	-13.11967	-17.09838
38.0	2.08151	3.18379	-0.79491	132.0	0.08101	-10.91450	-14.89321
40.0	2.25424	3.53001	-0.44869	134.0	0.12501	-9.03038	-13.00909
42.0	2.37707	3.76042	-0.21828	136.0	0.17360	-7.60458	-11.58329
44.0	2.45397	3.89870	-0.08001	138.0	0.21784	-6.61857	-10.59727
46.0	2.49205	3.96557	0.01313	140.0	0.24850	-6.04674	-10.02544
48.0	2.49960	3.97870	0.00000	142.0	0.25786	-5.88621	-9.86492
50.0	2.48451	3.95241	-0.02629	144.0	0.24176	-6.16624	-10.14494
52.0	2.45332	3.89755	-0.08115	146.0	0.20124	-6.96275	-10.94146
54.0	2.41075	3.82152	-0.15719	148.0	0.14333	-8.43650	-12.41521
56.0	2.35973	3.72862	-0.25009	150.0	0.08039	-10.94786	-14.92656
58.0	2.30177	3.62062	-0.35809	152.0	0.02801	-15.52684	-19.50554
60.0	2.23743	3.49749	-0.48121	154.0	0.00156	-28.07083	-32.04954
62.0	2.16680	3.35818	-0.62052	156.0	0.01213	-19.16061	-23.13931
64.0	2.08990	3.20126	-0.77744	158.0	0.06291	-12.01246	-15.99116
66.0	2.00700	3.02546	-0.95324	160.0	0.14714	-8.32262	-12.30132
68.0	1.91867	2.82999	-1.14871	162.0	0.24854	-6.04605	-10.02476
70.0	1.82589	2.61474	-1.36397	164.0	0.34454	-4.62763	-8.60634
72.0	1.72994	2.38032	-1.59838	166.0	0.41174	-3.85376	-7.83246
74.0	1.63233	2.12805	-1.85061	168.0	0.43228	-3.64232	-7.62102
76.0	1.53464	1.86005	-2.11865	170.0	0.39928	-3.98724	-7.96595
78.0	1.43839	1.57876	-2.39994	172.0	0.31958	-4.95415	-8.93285
80.0	1.34499	1.28719	-2.69151	174.0	0.21279	-6.72059	-10.69929
82.0	1.25562	0.98858	-2.96012	176.0	0.10640	-9.73060	-13.70930
84.0	1.17119	0.68627	-3.29244	178.0	0.02852	-15.44833	-19.42704
86.0	1.09200	0.38943	-3.59527	180	0.00000	-INFINITY	-INFINITY
88.0	1.01926	0.08387	-3.89584				
90.0	0.95205	0.21333	-4.19204				

TABLE A2-36

EPSLN= 8.7500(NORMALIZED GROUNDPLANE RADIUS)
 MONOPOLE LENGTH= 0.250000(WAVELENGTH)
 MONOPOLE RADIUS= 0.1000E-05(WAVELENGTH)
 NUMBER OF MONOPOLE SEGMENTS= 1
 NUMBER OF DISK SEGMENTS= 26
 NUMBER OF ANNULAR ZONES PER DISK SEGMENT= 1
 RADIATION RESISTANCE DETERMINED BY PATTERN= 0.317823E+02 OHMS

ELEVATION ANGLE (DEG)	DIRECTIVITY (NUMERIC)	DIRECTIVITY (dBi)	RELATIVE POWER (dB)	ELEVATION ANGLE (DEG)	DIRECTIVITY (NUMERIC)	DIRECTIVITY (dBi)	RELATIVE POWER (dB)
0.	0.00000	-INFINITY	-INFINITY	92.0	0.88059	-0.55228	-4.21437
2.0	0.02410	-16.18012	-19.84221	94.0	0.82469	-0.83711	-4.49920
4.0	0.08915	-10.49883	-14.16092	96.0	0.77544	-1.10453	-4.76661
6.0	0.17582	-7.54944	-11.21153	98.0	0.73177	-1.35623	-5.01832
8.0	0.25904	-5.86625	-9.52834	100.0	0.69237	-1.59663	-5.25872
10.0	0.31629	-4.99921	-8.66130	102.0	0.65368	-1.83309	-5.49318
12.0	0.33483	-4.75177	-8.41386	104.0	0.62001	-2.07601	-5.73810
14.0	0.31596	-5.00364	-8.64573	106.0	0.58360	-2.33886	-6.00095
16.0	0.27474	-5.61073	-9.27282	108.0	0.54873	-2.63819	-6.30028
18.0	0.23569	-6.27666	-9.93875	110.0	0.50191	-2.99374	-6.65983
20.0	0.22590	-6.46081	-10.12290	112.0	0.45406	-3.42890	-7.09099
22.0	0.26787	-5.72070	-9.38279	114.0	0.40072	-3.97156	-7.63365
24.0	0.37395	-4.27185	-7.93394	116.0	0.34232	-4.65566	-8.31775
26.0	0.54389	-2.64488	-6.30697	118.0	0.28031	-5.52354	-9.18563
28.0	0.76574	-1.15919	-4.82128	120.0	0.21730	-6.62931	-10.29140
30.0	1.01938	0.08335	-3.57874	122.0	0.15498	-8.04150	-11.70359
32.0	1.28143	1.07696	-2.58513	124.0	0.10387	-9.83524	-13.49733
34.0	1.53013	1.84729	-1.81480	126.0	0.06281	-12.01988	-15.68197
36.0	1.74894	2.42776	-1.23433	128.0	0.03825	-14.17390	-17.83599
38.0	1.92841	2.85199	-0.81010	130.0	0.03332	-14.77316	-18.43525
40.0	2.06812	3.15156	-0.51053	132.0	0.04890	-13.10707	-16.76916
42.0	2.16533	3.35523	-0.30686	134.0	0.08286	-10.81678	-14.47887
44.0	2.23270	3.48830	-0.17379	136.0	0.12971	-8.87031	-12.53240
46.0	2.27608	3.57187	-0.09022	138.0	0.18095	-7.42450	-11.08459
48.0	2.30261	3.62221	-0.03988	140.0	0.22615	-6.45607	-10.11816
50.0	2.31755	3.65030	-0.01179	142.0	0.25487	-5.93681	-9.59890
52.0	2.32385	3.66209	0.00000	144.0	0.25903	-5.86650	-9.52859
54.0	2.32231	3.65921	-0.00288	146.0	0.23528	-6.28408	-9.94616
56.0	2.31217	3.64020	-0.02189	148.0	0.18672	-7.28801	-10.95010
58.0	2.29184	3.60185	-0.06024	150.0	0.12322	-9.09304	-12.75313
60.0	2.25963	3.54036	-0.12172	152.0	0.06000	-12.21820	-15.88029
62.0	2.21425	3.45227	-0.20982	154.0	0.01438	-18.42110	-22.08319
64.0	2.15524	3.33497	-0.32712	156.0	0.00133	-28.75558	-32.41767
66.0	2.08303	3.18695	-0.47514	158.0	0.02889	-15.39267	-19.05476
68.0	1.99890	3.00791	-0.65418	160.0	0.09489	-10.22778	-13.88987
70.0	1.90485	2.79862	-0.86347	162.0	0.18623	-7.29953	-10.96161
72.0	1.80336	2.56081	-1.10128	164.0	0.28134	-5.50776	-9.16985
74.0	1.69711	2.29709	-1.36500	166.0	0.35556	-4.49081	-8.15290
76.0	1.58882	2.01075	-1.65134	168.0	0.38817	-4.10980	-7.77189
78.0	1.48105	1.70570	-1.95639	170.0	0.36878	-4.33228	-7.99437
80.0	1.37605	1.38635	-2.27574	172.0	0.30130	-5.21002	-8.87210
82.0	1.27571	1.05750	-2.60459	174.0	0.20358	-6.91272	-10.57481
84.0	1.18148	0.72427	-2.93782	176.0	0.10281	-9.87981	-13.54190
86.0	1.09442	0.39185	-3.27024	178.0	0.02772	-15.57274	-19.23483
88.0	1.01516	0.06533	-3.59676	180.0	0.00000	-INFINITY	-INFINITY
90.0	0.94392	-0.25064	-3.91573				

TABLE A2-37

EPSLN= 9.0000(NORMALIZED GROUNDPLANE RADIUS)
 MONOPOLE LENGTH= 0.25000(WAVELENGTH)
 MONOPOLE RADIUS= 0.1000E-05(WAVELENGTH)
 NUMBER OF MONOPOLE SEGMENTS= 1
 NUMBER OF DISK SEGMENTS= 27
 NUMBER OF ANNUAL ZONES PER DISK SEGMENT= 1
 RADIATION RESISTANCE DETERMINED BY PATTERN= 0.328995E+02 OHMS

ELEVATION ANGLE (DEG)	DIRECTIVITY (NUMERIC)	DIRECTIVITY (dBi)	RELATIVE POWER (dB)	ELEVATION ANGLE (DEG)	DIRECTIVITY (NUMERIC)	DIRECTIVITY (dBi)	RELATIVE POWER (dB)
0.	0.00000	-INFINITY	-INFINITY	92.0	0.84199	-0.74694	-4.51648
2.0	0.02659	-15.75210	-19.52164	94.0	0.78223	-1.06666	-4.83620
4.0	0.09828	-10.07542	-13.84495	96.0	0.73193	-1.35533	-5.12487
6.0	0.19350	-7.13315	-10.90269	98.0	0.69010	-1.61088	-5.38042
8.0	0.28453	-5.45871	-9.22825	100.0	0.65547	-1.83449	-5.60402
10.0	0.34669	-4.60055	-8.37009	102.0	0.62645	-2.03116	-5.80070
12.0	0.36643	-4.36007	-8.12961	104.0	0.60117	-2.21000	-5.97954
14.0	0.34555	-4.61494	-8.38448	106.0	0.57755	-2.38409	-6.15363
16.0	0.30041	-5.22288	-8.99242	108.0	0.55333	-2.57018	-6.33972
18.0	0.25673	-5.90518	-9.67472	110.0	0.52622	-2.78830	-6.55783
20.0	0.24185	-6.16453	-9.92406	112.0	0.49413	-3.06157	-6.83111
22.0	0.27708	-5.57391	-9.34345	114.0	0.45536	-3.41642	-7.18595
24.0	0.37248	-4.28897	-8.05851	116.0	0.40895	-3.88332	-7.65286
26.0	0.52519	-2.79683	-6.56637	118.0	0.35495	-4.49839	-8.26792
28.0	0.72143	-1.41808	-5.18762	120.0	0.29472	-5.30586	-9.07540
30.0	0.94096	-0.26427	-4.03381	122.0	0.23112	-6.36164	-10.13117
32.0	1.16254	0.65406	-3.11548	124.0	0.16841	-7.73633	-11.50586
34.0	1.36852	1.36252	-2.40701	126.0	0.11200	-9.50783	-13.27737
36.0	1.54786	1.89731	-1.87222	128.0	0.06779	-11.68835	-15.45788
38.0	1.69675	2.29618	-1.47335	130.0	0.04123	-13.84816	-17.61770
40.0	1.81755	2.59486	-1.17468	132.0	0.03614	-14.42059	-18.19012
42.0	1.91640	2.82486	-0.94468	134.0	0.05353	-12.71362	-16.48316
44.0	2.00063	3.01166	-0.75788	136.0	0.09072	-10.42276	-14.19229
46.0	2.07646	3.17323	-0.59631	138.0	0.14098	-8.50838	-12.27792
48.0	2.14758	3.31950	-0.45004	140.0	0.19415	-7.11873	-10.88827
50.0	2.21468	3.45311	-0.31643	142.0	0.23823	-6.23012	-9.99966
52.0	2.27375	3.57125	-0.19829	144.0	0.26190	-5.81867	-9.58820
54.0	2.32698	3.66793	-0.10161	146.0	0.25744	-5.89322	-9.66276
56.0	2.36383	3.73616	-0.03337	148.0	0.22336	-6.51001	-10.27955
58.0	2.38207	3.76954	0.00000	150.0	0.16583	-7.80331	-11.57284
60.0	2.37853	3.76309	-0.00645	152.0	0.09828	-10.07518	-13.84471
62.0	2.35161	3.71366	-0.03588	154.0	0.03867	-14.12583	-17.89537
64.0	2.30136	3.61984	-0.14970	156.0	0.00497	-23.03919	-26.80872
66.0	2.22935	3.48178	-0.28776	158.0	0.00980	-20.08930	-23.85884
68.0	2.13839	3.30087	-0.46866	160.0	0.05593	-12.52319	-16.29273
70.0	2.03214	3.07953	-0.69001	162.0	0.13421	-8.72219	-12.49173
72.0	1.91466	2.82091	-0.94862	164.0	0.22496	-6.47890	-10.24844
74.0	1.79012	2.52882	-1.24072	166.0	0.30310	-5.18417	-8.95371
76.0	1.66247	2.20753	-1.56201	168.0	0.34547	-4.61595	-8.38549
78.0	1.53526	1.86182	-1.90772	170.0	0.33836	-4.70621	-8.47574
80.0	1.41153	1.49690	-2.27264	172.0	0.28255	-5.48906	-9.25860
82.0	1.29374	1.11846	-2.65108	174.0	0.19388	-7.12461	-10.89415
84.0	1.18377	0.73267	-3.03697	176.0	0.09893	-10.04676	-13.81630
86.0	1.08297	0.34618	-3.42336	178.0	0.02683	-15.71382	-19.48336
88.0	0.99520	-0.03400	-3.80354	180.0	0.00000	-INFINITY	-INFINITY
90.0	0.91187	-0.40068	-4.17022				

TABLE A2-38

EPSLN= 9 2500(NORMALIZED GROUNDPLANE RADIUS)
 MONOPOLE LENGTH= 0.250000(WAVELENGTH)
 MONOPOLE RADIUS= 0.1000E-05(WAVELENGTH)
 NUMBER OF MONOPOLE SEGMENTS= 1
 NUMBER OF DISK SEGMENTS= 27
 NUMBER OF ANNUAL ZONES PER DISK SEGMENT= 1
 RADIATION RESISTANCE DETERMINED BY PATTERN= 0.346397E+02 OHMS

ELEVATION ANGLE (DEG)	DIRECTIVITY (NUMERIC)	DIRECTIVITY (dBi)	RELATIVE POWER (dB)	ELEVATION ANGLE (DEG)	DIRECTIVITY (NUMERIC)	DIRECTIVITY (dBi)	RELATIVE POWER (dB)
0.	0.00000	-INFINITY	-INFINITY	92.0	0.78629	-1.04419	-5.14925
2.0	0.02890	-15.39035	-19.49540	94.0	0.71882	-1.78380	-5.53886
4.0	0.10666	-9.72003	-13.82509	96.0	0.66316	-1.78381	-5.88887
6.0	0.20949	-6.78837	-10.89343	98.0	0.61854	-2.08632	-6.19138
8.0	0.30698	-5.12893	-9.23399	100.0	0.58390	-2.33658	-6.44164
10.0	0.37232	-4.29080	-8.39586	102.0	0.55789	-2.53451	-6.63957
12.0	0.39107	-4.07748	-8.18254	104.0	0.53880	-2.68572	-6.79078
14.0	0.36536	-4.37280	-8.47786	106.0	0.52458	-2.80186	-6.90692
16.0	0.31258	-5.05034	-9.15540	108.0	0.51285	-2.90010	-7.00516
18.0	0.25925	-5.86278	-9.96784	110.0	0.50094	-3.00214	-7.10719
20.0	0.23255	-6.33475	-10.43981	112.0	0.48606	-3.13308	-7.23814
22.0	0.25855	-5.97653	-10.08159	114.0	0.46551	-3.32074	-7.42580
24.0	0.32737	-4.84957	-8.95463	116.0	0.43696	-3.59558	-7.70063
26.0	0.45255	-3.44336	-7.54842	118.0	0.39890	-3.99137	-8.09643
28.0	0.61400	-2.11831	-6.22337	120.0	0.35100	-4.54697	-8.65203
30.0	0.79328	-1.00571	-5.11077	122.0	0.29451	-5.30901	-9.41407
32.0	0.97306	-0.57362	-4.22367	124.0	0.23251	-6.33553	-10.44059
34.0	1.14120	0.57362	-3.53144	126.0	0.16988	-7.69846	-11.80351
36.0	1.29261	1.11468	-2.99038	128.0	0.11292	-9.47229	-13.57735
38.0	1.42868	1.54934	-2.55572	130.0	0.06852	-11.64182	-15.74688
40.0	1.55503	1.91738	-2.18768	132.0	0.04298	-13.66719	-17.77225
42.0	1.67857	2.24940	-1.85566	134.0	0.04053	-13.92190	-18.02696
44.0	1.80478	2.56424	-1.54082	136.0	0.06191	-12.08227	-16.18733
46.0	1.93584	2.86870	-1.23636	138.0	0.10337	-9.85607	-13.96113
48.0	2.07006	3.15983	-0.94523	140.0	0.15654	-8.05377	-12.15882
50.0	2.20225	3.42867	-0.67639	142.0	0.20947	-6.78882	-10.89388
52.0	2.32497	3.66417	-0.44088	144.0	0.24889	-6.03996	-10.14502
54.0	2.43001	3.85608	-0.24898	146.0	0.26340	-5.79378	-9.89884
56.0	2.50984	3.99646	-0.10860	148.0	0.24688	-6.07520	-10.18025
58.0	2.56874	4.08026	0.02480	150.0	0.20100	-6.96794	-11.07300
60.0	2.57339	4.10506	0.00000	152.0	0.13606	-8.66283	-12.76789
62.0	2.55310	4.07068	-0.03438	154.0	0.06910	-11.60501	-15.71007
64.0	2.49953	3.97859	-0.12647	156.0	0.01979	-17.03657	-21.14163
66.0	2.41428	3.83147	-0.27359	158.0	0.00452	-23.44414	-27.54920
68.0	2.30822	3.63278	-0.47228	160.0	0.03090	-15.10029	-19.20535
70.0	2.18058	3.38651	-0.71855	162.0	0.09416	-10.26148	-14.36654
72.0	2.04031	3.09696	-1.00809	164.0	0.17742	-7.51009	-11.61515
74.0	1.89176	2.76866	-1.33640	166.0	0.25607	-5.91640	-10.02145
76.0	1.74032	2.40628	-1.69878	168.0	0.30533	-5.15227	-9.25733
78.0	1.59027	2.01470	-2.09036	170.0	0.30856	-5.10661	-9.21167
80.0	1.44512	1.59904	-2.50602	172.0	0.26345	-5.79306	-9.89812
82.0	1.30762	1.16482	-2.94024	174.0	0.18362	-7.36089	-11.46595
84.0	1.17561	0.71811	-3.38645	176.0	0.09467	-10.23795	-14.34301
86.0	1.06309	0.26569	-3.83937	178.0	0.02583	-15.87912	-19.98418
88.0	0.95835	-0.18474	-4.28980	180.0	0.00000	-INFINITY	-INFINITY
90.0	0.85606	-0.62453	-4.72929				

TABLE A2-39

EPSLN= 9.5000(NORMALIZED GROUNDPLANE RADIUS)
 MONOPOLE LENGTH= 0.25000(WAVELENGTH)
 MONOPOLE RADIUS= 0.1000E-05(WAVELENGTH)
 NUMBER OF MONOPOLE SEGMENTS= 1
 NUMBER OF DISK SEGMENTS= 28
 NUMBER OF ANNULAR ZONES PER DISK SEGMENT= 1
 RADIATION RESISTANCE DETERMINED BY PATTERN= 0.365792E+02 OHMS

ELEVATION ANGLE (DEG)	DIRECTIVITY (NUMERIC)	DIRECTIVITY (dBi)	RELATIVE POWER (dB)	ELEVATION ANGLE (DEG)	DIRECTIVITY (NUMERIC)	DIRECTIVITY (dBi)	RELATIVE POWER (dB)
0.	0.00000	-INFINITY	-INFINITY	92.0	0.72979	-1.36804	-5.83853
2.0	0.03092	-15.09731	-19.56780	94.0	0.65287	-1.85173	-6.32221
4.0	0.11392	-9.43396	-13.90444	96.0	0.58905	-2.29850	-6.76899
6.0	0.22314	-6.51417	-10.98466	98.0	0.53780	-2.69379	-7.16427
8.0	0.32568	-4.87215	-9.34264	100.0	0.49843	-3.02399	-7.49448
10.0	0.39276	-4.05873	-8.52922	102.0	0.46997	-3.27926	-7.74974
12.0	0.40909	-3.88178	-8.35226	104.0	0.45119	-3.45640	-7.92689
14.0	0.37703	-4.23606	-8.70655	106.0	0.44044	-3.56114	-8.03162
16.0	0.31470	-5.02109	-9.49137	108.0	0.43565	-3.60862	-8.07911
18.0	0.24894	-6.03913	-10.50962	110.0	0.43429	-3.62217	-8.09265
20.0	0.20650	-6.85087	-11.32136	112.0	0.43343	-3.63086	-8.10135
22.0	0.20619	-6.85724	-11.32772	114.0	0.42982	-3.66709	-8.13758
24.0	0.25479	-5.93820	-10.40868	116.0	0.42024	-3.76499	-8.23548
26.0	0.34729	-4.59308	-9.06357	118.0	0.40179	-3.96001	-8.43050
28.0	0.47086	-3.27108	-7.74156	120.0	0.37241	-4.28984	-8.76033
30.0	0.61042	-2.14368	-6.61417	122.0	0.33140	-4.79643	-9.26691
32.0	0.75382	-1.22730	-5.69778	124.0	0.27996	-5.52904	-9.99953
34.0	0.89496	-0.48196	-4.95245	126.0	0.22142	-6.54786	-11.01834
36.0	1.03427	0.14636	-4.32413	128.0	0.16127	-7.92451	-12.39500
38.0	1.17695	0.70758	-3.76291	130.0	0.10664	-9.72085	-14.19133
40.0	1.32980	1.23787	-3.23261	132.0	0.06526	-11.85324	-16.32372
42.0	1.49807	1.75532	-2.71516	134.0	0.04397	-13.56878	-18.03927
44.0	1.68305	2.26097	-2.20952	136.0	0.04689	-13.28906	-17.75955
46.0	1.88111	2.74415	-1.72634	138.0	0.07391	-11.31311	-15.78359
48.0	2.08412	3.18923	-1.28126	140.0	0.11968	-9.21992	-13.69041
50.0	2.28087	3.58100	-0.88948	142.0	0.17389	-7.59717	-12.06765
52.0	2.45907	3.90771	-0.56278	144.0	0.22299	-6.51706	-10.98735
54.0	2.60730	4.16192	-0.30857	146.0	0.25322	-5.96505	-10.43534
56.0	2.71658	4.34022	-0.13027	148.0	0.25444	-5.94422	-10.41471
58.0	2.78124	4.44239	-0.02810	150.0	0.22369	-6.50357	-10.97406
60.0	2.79929	4.47049	0.00000	152.0	0.16718	-7.76819	-12.23868
62.0	2.77210	4.42808	-0.04240	154.0	0.09968	-10.01403	-14.48452
64.0	2.70375	4.31966	-0.15083	156.0	0.04098	-13.87390	-18.34439
66.0	2.60027	4.15018	-0.32031	158.0	0.01010	-19.95706	-24.42755
68.0	2.46876	3.92478	-0.54570	160.0	0.01879	-17.26167	-21.73216
70.0	2.31664	3.64859	-0.82170	162.0	0.06675	-11.75580	-16.22629
72.0	2.15109	3.32658	-1.14390	164.0	0.21672	-8.52417	-12.99466
74.0	1.97858	2.96354	-1.50694	166.0	0.26992	-6.64099	-11.11148
76.0	1.80470	2.56406	-1.90643	168.0	0.28111	-5.51124	-10.15811
78.0	1.63401	2.13256	-2.33793	170.0	0.24517	-6.10527	-10.57576
80.0	1.47008	1.67342	-2.79707	172.0	0.17345	-7.60832	-12.07881
82.0	1.31557	1.19113	-3.27936	174.0	0.09032	-10.44231	-14.91279
84.0	1.17233	0.69050	-3.77976	176.0	0.02478	-16.05877	-20.52925
86.0	1.04160	0.17701	-4.29347	180.0	0.00000	-INFINITY	-INFINITY
88.0	0.92409	-0.34285	-4.81333				
90.0	0.82014	-0.86113	-5.33162				

TABLE A2-40

EPSLN= 9.7500(NORMALIZED GROUNDPLANE RADIUS)
 MONOPOLE LENGTH= 0.250000(WAVELENGTH)
 MONOPOLE RADIUS= 0.1000E-05(WAVELENGTH)
 NUMBER OF MONOPOLE SEGMENTS= 1
 NUMBER OF DISK SEGMENTS= 29
 NUMBER OF ANNUAL ZONES PER DISK SEGMENT= 1
 RADIATION RESISTANCE DETERMINED BY PATTERN= 0.380863E+02 OHMS

ELEVATION ANGLE (DEG)	DIRECTIVITY (NUMERIC)	DIRECTIVITY (dBi)	RELATIVE POWER (dB)	ELEVATION ANGLE (DEG)	DIRECTIVITY (NUMERIC)	DIRECTIVITY (dBi)	RELATIVE POWER (dB)
0.	0.00000	-INFINITY	-INFINITY	92.0	0.68892	-1.61833	-6.39138
2.0	0.03276	-14.84643	-19.61948	94.0	0.60348	-2.19341	-6.96645
4.0	0.12052	-9.18932	-13.96236	96.0	0.53110	-2.74820	-7.52124
6.0	0.23550	-6.28011	-11.05316	98.0	0.47151	-3.26311	-8.03815
8.0	0.34249	-4.65357	-9.42662	100.0	0.42433	-3.72301	-8.49605
10.0	0.41095	-3.86209	-8.63514	102.0	0.38908	-4.09960	-8.87264
12.0	0.42483	-3.71783	-8.49087	104.0	0.36510	-4.37593	-9.14897
14.0	0.38664	-4.12692	-8.89997	106.0	0.35138	-4.54219	-9.31524
16.0	0.31492	-5.01795	-9.79099	108.0	0.34653	-4.60262	-9.37567
18.0	0.23667	-6.25860	-11.03165	110.0	0.34859	-4.57691	-9.34995
20.0	0.17799	-7.49607	-12.26912	112.0	0.35502	-4.49748	-9.27053
22.0	0.15661	-8.05193	-12.82498	114.0	0.36272	-4.40431	-9.17735
24.0	0.17847	-7.48427	-12.25731	116.0	0.36813	-4.33993	-9.11298
26.0	0.23903	-6.21544	-10.98849	118.0	0.36757	-4.34657	-9.11962
28.0	0.32779	-4.84408	-9.61713	120.0	0.35764	-4.46559	-9.23864
30.0	0.43396	-3.62552	-8.39857	122.0	0.33582	-4.73888	-9.51192
32.0	0.55096	-2.58882	-7.36187	124.0	0.30119	-5.21159	-9.98464
34.0	0.67831	-1.68573	-6.45877	126.0	0.25493	-5.93573	-10.70878
36.0	0.82077	-0.85778	-5.63082	128.0	0.20076	-6.97321	-11.74626
38.0	0.98544	-0.06368	-4.83673	130.0	0.14480	-8.39225	-13.16530
40.0	1.17815	0.71201	-4.06103	132.0	0.09493	-10.22583	-14.99888
42.0	1.40043	1.46260	-3.31045	134.0	0.05945	-12.25883	-17.03187
44.0	1.64790	2.16932	-2.60372	136.0	0.04520	-13.44885	-18.22190
46.0	1.91045	2.81136	-1.96168	138.0	0.05559	-12.54980	-17.32285
48.0	2.17370	3.37199	-1.40106	140.0	0.08893	-10.50938	-15.28243
50.0	2.42139	3.84666	-0.93239	142.0	0.13778	-8.60818	-13.38123
52.0	2.63797	4.21270	-0.56035	144.0	0.18984	-7.21609	-11.98913
54.0	2.81061	4.48801	-0.28504	146.0	0.23057	-6.37206	-11.14511
56.0	2.93065	4.66964	-0.10341	148.0	0.24701	-6.07283	-10.84588
58.0	2.99406	4.76260	-0.01044	150.0	0.23207	-6.34380	-11.11685
60.0	3.00127	4.77305	0.00000	152.0	0.18760	-7.26773	-12.04078
62.0	2.95638	4.70761	0.06544	154.0	0.12510	-9.02734	-13.80039
64.0	2.86618	4.57303	-0.20002	156.0	0.06321	-11.99197	-16.76501
66.0	2.73899	4.37590	-0.39715	158.0	0.02219	-16.53925	-21.31229
68.0	2.58373	4.12247	-0.65058	160.0	0.01700	-17.69659	-22.46963
70.0	2.40911	3.81856	-0.95449	162.0	0.05139	-12.89147	-17.66451
72.0	2.22305	3.46950	-1.30355	164.0	0.11536	-9.37934	-14.15239
74.0	2.03241	3.08011	-1.69294	166.0	0.18759	-7.26796	-12.04101
76.0	1.84276	2.65469	-2.11836	168.0	0.24239	-6.15482	-10.92786
78.0	1.65847	2.19708	-2.57596	170.0	0.25911	-5.86509	-10.63813
80.0	1.48277	1.71074	-3.06230	172.0	0.23026	-6.37787	-11.15092
82.0	1.31791	1.19865	-3.57420	174.0	0.16506	-7.82351	-12.59656
84.0	1.16533	0.66451	-4.10854	176.0	0.08671	-10.61912	-15.39217
86.0	1.02589	0.11102	-4.66203	178.0	0.02391	-16.21350	-20.98655
88.0	0.89998	-0.43768	-5.23073	180	0.00000	-INFINITY	-INFINITY
90.0	0.78768	-1.03648	-5.90952				

TABLE A2-41

EPSLN= 10.0000(NORMALIZED GROUNDPLANE RADIUS)
 MONOPOLE LENGTH= 0.250000(WAVELENGTH)
 MONOPOLE RADIUS= 0.1000E-05(WAVELENGTH)
 NUMBER OF MONOPOLE SEGMENTS= 1
 NUMBER OF DISK SEGMENTS= 30
 NUMBER OF ANNUAL ZONES PER DISK SEGMENT= 1
 RADIATION RESISTANCE DETERMINED BY PATTERN= 0.387759E+02 OHMS

ELEVATION ANGLE (DEG)	DIRECTIVITY (NUMERIC)	DIRECTIVITY (dBi)	RELATIVE POWER (dB)	ELEVATION ANGLE (DEG)	DIRECTIVITY (NUMERIC)	DIRECTIVITY (dBi)	RELATIVE POWER (dB)
0.	0.00000	-INFINITY	-INFINITY	92.0	0.67036	-1.73695	-6.72838
2.0	0.03473	-14.59347	-19.58491	94.0	0.50930	-2.37097	-7.36241
4.0	0.12761	-8.94129	-13.93272	96.0	0.50025	-3.00816	-7.99960
6.0	0.24887	-6.04019	-11.03163	98.0	0.43301	-3.63500	-8.62643
8.0	0.36100	-4.42494	-9.41638	100.0	0.37749	-4.23100	-9.22243
10.0	0.43167	-3.64846	-8.63989	102.0	0.33358	-4.76801	-9.75944
12.0	0.44410	-3.52517	-8.51661	104.0	0.30116	-5.21207	-10.20351
14.0	0.40098	-3.96879	-9.92208	106.0	0.27991	-5.52982	-10.52125
16.0	0.32132	-4.93065	-9.92208	108.0	0.26921	-5.69903	-10.69047
18.0	0.23221	-6.34119	-11.33262	110.0	0.26796	-5.71927	-10.71071
20.0	0.15922	-7.98002	-12.97146	112.0	0.27442	-5.61589	-10.60733
22.0	0.11920	-9.23742	-14.22885	114.0	0.28610	-5.43478	-10.42621
24.0	0.11770	-9.29233	-14.28377	116.0	0.29980	-5.23165	-10.22309
26.0	0.15113	-8.20640	-13.19784	118.0	0.31169	-5.06272	-10.05415
28.0	0.21183	-6.74021	-11.73165	120.0	0.31769	-4.97995	-9.97139
30.0	0.29346	-5.32453	-10.31596	122.0	0.31398	-5.03102	-10.02245
32.0	0.39466	-4.03780	-9.02923	124.0	0.29772	-5.26185	-10.25328
34.0	0.51959	-2.84338	-7.83482	126.0	0.26788	-5.72057	-10.71200
36.0	0.67582	-1.70169	-6.69312	128.0	0.22586	-6.46156	-11.45299
38.0	0.87058	-0.60193	-5.59337	130.0	0.17591	-7.54711	-12.53854
40.0	1.10702	0.44154	-4.54989	132.0	0.12489	-9.03487	-14.02631
42.0	1.38176	1.40432	-3.58712	134.0	0.08133	-10.89756	-15.88899
44.0	1.68431	2.26422	-2.72722	136.0	0.05376	-12.69535	-17.68678
46.0	1.99839	3.00681	-1.98463	138.0	0.04849	-13.14338	-18.13481
48.0	2.30453	3.62582	-1.36562	140.0	0.06743	-11.71162	-16.70305
50.0	2.58310	4.12142	-0.87002	142.0	0.10660	-9.72240	-14.71383
52.0	2.81715	4.49810	-0.49334	144.0	0.15612	-8.06543	-13.05687
54.0	2.99429	4.76294	-0.22849	146.0	0.20200	-6.94639	-11.93782
56.0	3.10770	4.92439	-0.06704	148.0	0.22979	-6.38664	-11.37807
58.0	3.15605	4.99143	0.00000	150.0	0.22909	-6.39993	-11.39137
60.0	3.14274	4.97308	-0.01835	152.0	0.19765	-7.04093	-12.03236
62.0	3.07472	4.87806	-0.11338	154.0	0.14335	-8.43591	-13.42734
64.0	2.96113	4.71458	-0.27685	156.0	0.08279	-10.82008	-15.81152
66.0	2.81208	4.49028	-0.50116	158.0	0.03645	-14.38318	-19.37461
68.0	2.63760	4.21209	-0.77934	160.0	0.02158	-16.65960	-21.65103
70.0	2.44696	3.88626	-1.10517	162.0	0.04536	-13.43369	-18.42513
72.0	2.24818	3.51930	-1.47313	164.0	0.10105	-9.95448	-14.94591
74.0	2.04786	3.11299	-1.87844	166.0	0.16933	-7.71278	-12.70421
76.0	1.85114	2.67439	-2.31704	168.0	0.22469	-6.48416	-11.47560
78.0	1.66184	2.20588	-2.78555	170.0	0.24515	-6.10574	-11.09717
80.0	1.48258	1.71017	-3.28126	172.0	0.22118	-6.55246	-11.54390
82.0	1.31504	1.18939	-3.80204	174.0	0.16031	-7.95040	-12.94184
84.0	1.16016	0.64519	-4.34625	176.0	0.08485	-10.71372	-15.70515
86.0	1.01833	0.07889	-4.91254	178.0	0.02350	-16.28937	-21.28080
88.0	0.88937	-0.50821	-5.49964	180.0	0.00000	-INFINITY	-INFINITY
90.0	0.77368	-1.11441	-6.10584				

TABLE A2-42

EPSLN= 10.2500(NORMALIZED GROUNDPLANE RADIUS)
 MONOPOLE LENGTH= 0.250000(WAVELENGTH)
 MONOPOLE RADIUS= 0.1000E-05(WAVELENGTH)
 NUMBER OF MONOPOLE SEGMENTS= 1
 NUMBER OF DISK SEGMENTS= 30
 NUMBER OF ANNULAR ZONES PER DISK SEGMENT= 1
 RADIATION RESISTANCE DETERMINED BY PATTERN= 0.385880E+02 OHMS

ELEVATION ANGLE (DEG)	DIRECTIVITY (NUMERIC)	DIRECTIVITY (dbi)	RELATIVE POWER (db)	ELEVATION ANGLE (DEG)	DIRECTIVITY (NUMERIC)	DIRECTIVITY (dbi)	RELATIVE POWER (db)
0.	0.00000	-INFINITY	-INFINITY	92.0	0.67349	-1.71669	-6.83662
2.0	0.03708	-14.30827	-19.42820	94.0	0.58025	-2.36385	-7.48378
4.0	0.13615	-8.65979	-13.77972	96.0	0.49737	-3.03319	-8.15312
6.0	0.26519	-5.76440	-10.88433	98.0	0.42466	-3.71956	-8.83949
8.0	0.38404	-4.15618	-9.27611	100.0	0.36211	-4.41164	-9.53157
10.0	0.45844	-3.38719	-8.50712	102.0	0.30984	-5.08857	-10.20850
12.0	0.47083	-3.27139	-8.39132	104.0	0.26812	-5.71673	-10.83666
14.0	0.42421	-3.72418	-8.84411	106.0	0.23718	-6.24926	-11.36918
16.0	0.33829	-4.70707	-9.82700	108.0	0.21712	-6.63290	-11.75283
18.0	0.24048	-6.18921	-11.30914	110.0	0.20773	-6.82496	-11.94489
20.0	0.15599	-8.06902	-13.18894	112.0	0.20823	-6.81456	-11.93448
22.0	0.10100	-9.95700	-15.07693	114.0	0.21710	-6.63331	-11.75324
24.0	0.08086	-10.92256	-16.04249	116.0	0.23195	-6.34614	-11.46606
26.0	0.09313	-10.30931	-15.42924	118.0	0.24942	-6.03062	-11.15054
28.0	0.13294	-8.76360	-13.88353	120.0	0.26545	-5.76022	-10.88015
30.0	0.19815	-7.03016	-12.15009	122.0	0.27556	-5.59788	-10.71780
32.0	0.29188	-5.34791	-10.46784	124.0	0.27559	-5.59734	-10.71727
34.0	0.42184	-3.74850	-8.86843	126.0	0.26254	-5.80812	-10.92804
36.0	0.59700	-2.24028	-7.36020	128.0	0.23545	-6.28096	-11.40089
38.0	0.82334	-0.84422	-5.96414	130.0	0.19624	-7.07218	-12.19211
40.0	1.10031	0.41516	-4.70477	132.0	0.14991	-8.24159	-13.36152
42.0	1.41918	1.52038	-3.59955	134.0	0.10419	-9.82154	-14.94147
44.0	1.76363	2.46407	-2.65586	136.0	0.0816	-11.66478	-16.78471
46.0	2.11225	3.24745	-1.87247	138.0	0.05012	-12.99990	-18.11983
48.0	2.44201	3.87748	-1.24245	140.0	0.03512	-12.58719	-17.70712
50.0	2.73172	4.36436	-0.75556	142.0	0.08273	-10.82345	-15.94337
52.0	2.96477	4.71990	-0.40003	144.0	0.12609	-8.99320	-14.11313
54.0	3.13066	4.95636	-0.16357	146.0	0.17281	-7.62432	-12.74424
56.0	3.22540	5.08584	-0.03409	148.0	0.21899	-6.81892	-11.93884
58.0	3.25082	5.11993	0.00000	150.0	0.21899	-6.81892	-11.93884
60.0	3.21328	5.06949	0.05044	152.0	0.19989	-6.99211	-12.11204
62.0	3.12217	4.94457	-0.17536	154.0	0.15498	-8.09736	-13.21729
64.0	2.98835	4.75431	-0.36562	156.0	0.09842	-10.06923	-15.18916
66.0	2.82291	4.50697	-0.61296	158.0	0.05025	-12.98836	-18.10829
68.0	2.63628	4.20991	-0.91002	160.0	0.02932	-15.32831	-20.44824
70.0	2.43757	3.86958	-1.25035	162.0	0.04564	-13.40691	-18.52684
72.0	2.23437	3.49155	-1.62838	164.0	0.09536	-10.20648	-15.32641
74.0	2.03261	3.08053	-2.03940	166.0	0.16090	-7.93433	-13.05426
76.0	1.83671	2.64042	-2.47951	168.0	0.21691	-6.63722	-11.75715
78.0	1.64978	2.17426	-2.94566	170.0	0.24009	-6.19624	-11.31617
80.0	1.47379	1.68435	-3.43558	172.0	0.21913	-6.59291	-11.71284
82.0	1.30984	1.17218	-3.94775	174.0	0.16020	-7.95331	-13.07324
84.0	1.15838	0.63851	-4.48142	176.0	0.08530	-10.69064	-15.81057
86.0	1.01940	0.08343	-5.03650	178.0	0.02371	-16.25104	-21.37097
88.0	0.89257	-0.49356	-5.61349	180	0.00000	-INFINITY	-INFINITY
90.0	0.77744	-1.09338	-6.21324				

TABLE A2-43

EPSLN= 10.5000(NORMALIZED GROUNDPLANE RADIUS)
 MONOPOLE LENGTH= 0.250000(WAVELENGTH)
 MONOPOLE RADIUS= 0.1000E-05(WAVELENGTH)
 NUMBER OF MONOPOLE SEGMENTS= 1
 NUMBER OF DISK SEGMENTS= 31
 NUMBER OF ANNUAL ZONES PER DISK SEGMENT= 1
 RADIATION RESISTANCE DETERMINED BY PATTERN= 0.378627E+02 OHMS

ELEVATION ANGLE (DEG)	DIRECTIVITY (NUMERIC)	DIRECTIVITY (dBI)	RELATIVE POWER (dB)	ELEVATION ANGLE (DEG)	DIRECTIVITY (NUMERIC)	DIRECTIVITY (dBI)	RELATIVE POWER (dB)
0.	0.00000	-INFINITY	-INFINITY	92.0	0.69076	-1.60675	-6.77069
2.0	0.04012	-13.96648	-19.13043	94.0	0.59832	-2.23066	-7.39460
4.0	0.14719	-8.32129	-13.48524	96.0	0.51432	-2.88594	-8.04988
6.0	0.28438	-5.43065	-10.59459	98.0	0.43906	-3.57477	-8.73872
8.0	0.41425	-3.82737	-8.99132	100.0	0.37185	-4.29633	-9.46027
10.0	0.49413	-3.06157	-8.22551	102.0	0.31307	-5.04352	-10.20746
12.0	0.50766	-2.94431	-8.10825	104.0	0.26315	-5.79798	-10.96193
14.0	0.45941	-3.38748	-8.55143	106.0	0.22266	-6.52360	-11.68754
16.0	0.36723	-4.35060	-9.51454	108.0	0.19225	-7.16134	-12.32529
18.0	0.26230	-5.81201	-10.97596	110.0	0.17245	-7.63343	-12.79738
20.0	0.16877	-7.72697	-12.89092	112.0	0.16343	-7.86674	-13.03069
22.0	0.10225	-9.90342	-15.06737	114.0	0.16475	-7.83179	-12.99574
24.0	0.06786	-11.68378	-16.84773	116.0	0.17509	-7.56751	-12.73145
26.0	0.04412	-11.93006	-17.09401	118.0	0.19204	-7.16410	-12.33004
28.0	0.08872	-10.51967	-15.68362	120.0	0.21209	-6.73471	-11.89866
30.0	0.14323	-8.43964	-13.60359	122.0	0.23081	-6.36745	-11.53139
32.0	0.23457	-6.29724	-11.46119	124.0	0.24333	-6.13812	-11.30207
34.0	0.37304	-4.28244	-9.46638	126.0	0.24516	-6.10542	-11.26937
36.0	0.56802	-2.45637	-7.62032	128.0	0.23328	-6.32126	-11.48520
38.0	0.82338	-0.84402	-6.00796	130.0	0.20711	-6.83809	-12.00204
40.0	1.13435	0.54745	-4.61649	132.0	0.16935	-7.71218	-12.87613
42.0	1.48699	1.72278	-3.44116	134.0	0.12611	-8.99260	-14.15655
44.0	1.85954	2.69406	-2.46989	136.0	0.08406	-10.63202	-15.81597
46.0	2.22697	3.47714	-1.68481	138.0	0.05862	-12.31976	-17.48371
48.0	2.56408	4.08931	-1.07464	140.0	0.05131	-12.89804	-18.06199
50.0	2.84964	4.54791	-0.61604	142.0	0.06705	-11.73584	-16.89979
52.0	3.06874	4.86960	-0.29435	144.0	0.10227	-9.90371	-15.06665
54.0	3.21349	5.07004	-0.09390	146.0	0.14679	-8.33296	-13.49890
56.0	3.28377	5.16373	-0.00021	148.0	0.20618	-7.30027	-12.46422
58.0	3.28394	5.16395	0.00000	150.0	0.26180	-6.85762	-12.02156
60.0	3.22311	5.08276	-0.08119	152.0	0.19787	-7.03615	-12.20010
62.0	3.11246	4.93104	-0.23291	154.0	0.16211	-7.90185	-13.06579
64.0	2.96381	4.71850	-0.44545	156.0	0.11034	-9.56498	-14.72893
66.0	2.78851	4.45373	-0.71022	158.0	0.06246	-12.04431	-17.20825
68.0	2.59669	4.14421	-1.01974	160.0	0.03795	-14.20798	-19.37193
70.0	2.39685	3.79640	-1.36755	162.0	0.04953	-13.05140	-18.21535
72.0	2.19373	3.41579	-1.74816	164.0	0.09587	-10.18318	-15.34713
74.0	1.99845	3.00693	-2.15702	166.0	0.16076	-7.93809	-13.10204
76.0	1.80863	2.57351	-2.59044	168.0	0.21855	-6.60453	-11.76848
78.0	1.62869	2.11838	-3.04557	170.0	0.24434	-6.12001	-11.28395
80.0	1.46002	1.64359	-3.52035	172.0	0.22498	-6.47859	-11.64254
82.0	1.30328	1.15039	-4.01356	174.0	0.16561	-7.80917	-12.97312
84.0	1.15856	0.63918	-4.52476	176.0	0.08861	-10.52536	-15.68931
86.0	1.02555	0.10956	-5.05438	178.0	0.02470	-16.07319	-21.23713
88.0	0.90370	-0.43976	-5.60370	180.	0.00000	-INFINITY	-INFINITY
90.0	0.79234	-1.01090	-6.17485				

TABLE A2-44

EPSLN= 10.7500(NORMALIZED GROUNDPLANE RADIUS)
 MONOPOLE LENGTH= 0.250000(WAVELENGTH)
 MONOPOLE RADIUS= 0.1000E-05(WAVELENGTH)
 NUMBER OF MONOPOLE SEGMENTS= 1
 NUMBER OF DISK SEGMENTS= 32
 NUMBER OF ANNULAR ZONES PER DISK SEGMENT= 1
 RADIATION RESISTANCE DETERMINED BY PATTERN= 0.368938E+02 OHMS

ELEVATION ANGLE (DEG)	DIRECTIVITY (NUMERIC)	DIRECTIVITY (dBi)	RELATIVE POWER (dB)	ELEVATION ANGLE (DEG)	DIRECTIVITY (NUMERIC)	DIRECTIVITY (dBi)	RELATIVE POWER (dB)
0.	0.00000	-INFINITY	-INFINITY	92.0	0.71581	-1.45200	-6.62348
2.0	0.04402	-13.56330	-18.73479	94.0	0.62636	-2.03174	-7.20323
4.0	0.16136	-7.92195	-13.09344	96.0	0.54410	-2.64322	-7.81470
6.0	0.31356	-5.03682	-10.20831	98.0	0.46851	-3.29277	-8.46425
8.0	0.45298	-3.43917	-8.61065	100.0	0.39935	-3.98649	-9.15798
10.0	0.53996	-2.67639	-7.84788	102.0	0.33664	-4.72840	-9.89988
12.0	0.55525	-2.55314	-7.72662	104.0	0.28074	-5.51691	-10.68840
14.0	0.50347	-2.98029	-8.15177	106.0	0.23235	-6.33858	-11.51007
16.0	0.40728	-3.90108	-9.07256	108.0	0.19239	-7.15823	-12.32972
18.0	0.29619	-5.28424	-10.45572	110.0	0.16191	-7.90733	-13.07881
20.0	0.19599	-7.08456	-12.25805	112.0	0.14187	-8.48120	-13.65268
22.0	0.12043	-9.19254	-14.36402	114.0	0.13284	-8.76675	-13.93824
24.0	0.07534	-11.22959	-16.40108	116.0	0.13468	-8.35107	-13.87854
26.0	0.05942	-12.26043	-17.43192	118.0	0.14618	-8.35107	-13.52256
28.0	0.07252	-11.39556	-16.56705	120.0	0.16485	-7.82903	-13.00052
30.0	0.11945	-9.22807	-14.39956	122.0	0.18685	-7.28501	-12.45650
32.0	0.21042	-6.76915	-11.94063	124.0	0.20727	-6.83469	-12.00618
34.0	0.35768	-4.46500	-9.63648	126.0	0.22076	-6.56071	-11.73219
36.0	0.57039	-2.43825	-7.60973	128.0	0.22261	-6.52447	-11.69596
38.0	0.84981	-0.70676	-5.87825	130.0	0.20994	-6.77896	-11.95044
40.0	1.18683	0.74390	-4.42759	132.0	0.18293	-7.37711	-12.54860
42.0	1.56246	1.93810	-3.23339	134.0	0.14551	-8.37105	-13.54254
44.0	1.95092	2.90240	-2.26909	136.0	0.10518	-9.78084	-14.95233
46.0	2.32414	3.66263	-1.50886	138.0	0.07159	-11.45117	-16.62266
48.0	2.65632	4.24280	-0.92868	140.0	0.03410	-12.66816	-17.83965
50.0	2.92742	4.66486	-0.50663	142.0	0.03858	-12.32267	-17.49416
52.0	3.12512	4.94867	-0.22282	144.0	0.08478	-10.71689	-15.88838
54.0	3.24501	5.11216	-0.05932	146.0	0.12520	-9.02397	-14.19545
56.0	3.28964	5.17149	0.00000	148.0	0.16643	-7.78778	-12.95927
58.0	3.26669	5.14108	-0.03040	150.0	0.19320	-7.13995	-12.31144
60.0	3.18700	5.03382	-0.13767	152.0	0.19406	-7.12065	-12.29214
62.0	3.06270	4.86105	-0.31044	154.0	0.16663	-7.78258	-12.95407
64.0	2.90584	4.63271	-0.53878	156.0	0.12004	-9.20681	-14.37830
66.0	2.72734	4.35739	-0.81410	158.0	0.07284	-11.37630	-16.54778
68.0	2.53654	4.04241	-1.12908	160.0	0.04629	-13.34545	-18.51694
70.0	2.34098	3.69398	-1.47751	162.0	0.03529	-12.57349	-17.74497
72.0	2.14647	3.31726	-1.85423	164.0	0.10082	-9.76454	-15.13602
74.0	1.95726	2.91649	-2.25499	166.0	0.16760	-7.75730	-12.92878
76.0	1.77628	2.49512	-2.67636	168.0	0.22904	-6.40093	-11.57242
78.0	1.60540	2.05583	-3.11565	170.0	0.25805	-5.88295	-11.03443
80.0	1.44564	1.60660	-3.57088	172.0	0.23930	-6.21049	-11.38198
82.0	1.29739	1.13070	-4.04078	174.0	0.17717	-7.51605	-12.68753
84.0	1.16055	0.64665	-4.52484	176.0	0.09519	-10.21421	-15.38569
86.0	1.03470	0.14814	-5.02335	178.0	0.02660	-15.75121	-20.92270
88.0	0.91916	-0.36609	-5.53757	180	0.00000	-INFINITY	-INFINITY
90.0	0.81315	-0.89832	-6.06980				

TABLE A2-45

EPSLN= 11.0000(NORMALIZED GROUNDPLANE RADIUS)
 MONOPOLE LENGTH= 0.250000(WAVELENGTH)
 MONOPOLE RADIUS= 0.1000E-05(WAVELENGTH)
 NUMBER OF MONOPOLE SEGMENTS= 1
 NUMBER OF DISK SEGMENTS= 33
 NUMBER OF ANNULAR ZONES PER DISK SEGMENT= 1
 RADIATION RESISTANCE DETERMINED BY PATTERN= 0.359200E+02 OHMS

ELEVATION ANGLE (DEG)	DIRECTIVITY (NUMERIC)	DIRECTIVITY (dBi)	RELATIVE POWER (dB)	ELEVATION ANGLE (DEG)	DIRECTIVITY (NUMERIC)	DIRECTIVITY (dBi)	RELATIVE POWER (dB)
0.	0.00000	-INFINITY	-INFINITY	92.0	0.74289	-1.29073	-6.41431
2.0	0.04884	-13.11211	-18.23569	94.0	0.65773	-1.81955	-6.94312
4.0	0.17881	-7.47614	-12.59971	96.0	0.57880	-2.37475	-7.49832
6.0	0.34681	-4.59903	-9.72261	98.0	0.50534	-2.96413	-8.08770
8.0	0.49999	-3.01038	-8.13396	100.0	0.43682	-3.59693	-8.72050
10.0	0.59503	-2.25458	-7.37815	102.0	0.37299	-4.28308	-9.40665
12.0	0.61193	-2.13301	-7.25658	104.0	0.31394	-5.03152	-10.15509
14.0	0.55698	-2.54161	-7.66518	106.0	0.26022	-5.84664	-10.97022
16.0	0.45551	-3.41498	-8.53855	108.0	0.21275	-6.72123	-11.84480
18.0	0.33899	-4.69814	-9.82172	110.0	0.17284	-7.62358	-12.74715
20.0	0.23313	-6.32406	-11.44763	112.0	0.14195	-8.47856	-13.60214
22.0	0.15196	-8.18275	-13.30632	114.0	0.12150	-9.15415	-14.27772
24.0	0.09903	-10.04214	-15.16572	116.0	0.11246	-9.48998	-14.61356
26.0	0.07352	-11.33577	-16.45934	118.0	0.11493	-9.39548	-14.51906
28.0	0.07701	-11.13468	-16.25825	120.0	0.12775	-8.93654	-14.06011
30.0	0.11728	-9.30761	-14.43118	122.0	0.14814	-8.29333	-13.41691
32.0	0.20753	-6.82913	-11.95270	124.0	0.17176	-7.65070	-12.77428
34.0	0.36166	-4.41700	-9.54058	126.0	0.19307	-7.14276	-12.26633
36.0	0.58823	-2.30454	-7.42811	128.0	0.20621	-6.85690	-11.98047
38.0	0.88569	-0.52720	-5.65077	130.0	0.20631	-6.85483	-11.97840
40.0	1.24066	0.93652	-4.18706	132.0	0.19101	-7.18945	-12.31302
42.0	1.62969	2.12105	-3.00252	134.0	0.16172	-7.91236	-13.03593
44.0	2.02358	3.06120	-2.06238	136.0	0.12410	-9.06222	-14.18580
46.0	2.39264	3.78878	-1.33479	138.0	0.08730	-10.58965	-15.71322
48.0	2.71153	4.33214	-0.79143	140.0	0.06177	-12.09230	-17.21587
50.0	2.96235	4.71636	-0.40722	142.0	0.05595	-12.52222	-17.64579
52.0	3.13589	4.96361	-0.15996	144.0	0.07288	-11.37408	-16.49765
54.0	3.23114	5.09356	-0.03001	146.0	0.10798	-9.66655	-14.79012
56.0	3.25355	5.12357	0.00000	148.0	0.14938	-8.25714	-13.38071
58.0	3.21286	5.06892	-0.05465	150.0	0.18132	-7.41558	-12.53915
60.0	3.12098	4.94291	-0.18066	152.0	0.19005	-7.21131	-12.33488
62.0	2.99022	4.75702	-0.36655	154.0	0.17009	-7.69310	-12.81667
64.0	2.83205	4.52100	-0.60257	156.0	0.12810	-8.92462	-14.04820
66.0	2.65646	4.24304	-0.88054	158.0	0.08186	-10.86921	-15.99278
68.0	2.47167	3.92991	-1.19366	160.0	0.05395	-12.67992	-17.80349
70.0	2.28414	3.58722	-1.50635	162.0	0.06184	-12.08738	-17.21095
72.0	2.09873	3.21956	-1.90401	164.0	0.10877	-9.63473	-14.75830
74.0	1.91899	2.83072	-2.29286	166.0	0.18006	-7.44583	-12.56941
76.0	1.74736	2.42381	-2.59976	168.0	0.24747	-6.06477	-11.18834
78.0	1.58542	2.00144	-3.12214	170.0	0.28088	-5.51487	-10.63844
80.0	1.43406	1.56565	-3.55791	172.0	0.26222	-5.81333	-10.93691
82.0	1.29362	1.11807	-4.00550	174.0	0.19519	-7.09552	-12.21910
84.0	1.16403	0.65966	-4.46372	176.0	0.10527	-9.77685	-14.90042
86.0	1.04489	0.19673	-4.93886	178.0	0.02949	-15.30374	-20.42731
88.0	0.93555	-0.28933	-5.41290	180.0	0.00000	-INFINITY	-INFINITY
90.0	0.83519	-0.78216	-5.90573				

TABLE A2-46

EPSLN= 11 2500(NORMALIZED GROUNDPLANE RADIUS)
 MONOPOLE LENGTH= 0.250000(WAVELENGTH)
 MONOPOLE RADIUS= 0.1000E-03(WAVELENGTH)
 NUMBER OF MONOPOLE SEGMENTS= 1
 NUMBER OF DISK SEGMENTS= 33
 NUMBER OF ANNUAL ZONES PER DISK SEGMENT= 1
 RADIATION RESISTANCE DETERMINED BY PATTERN= 0.350770E+02 OHMS

ELEVATION ANGLE (DEG)	DIRECTIVITY (NUMERIC)	DIRECTIVITY (dBi)	RELATIVE POWER (dB)	ELEVATION ANGLE (DEG)	DIRECTIVITY (NUMERIC)	DIRECTIVITY (dBi)	RELATIVE POWER (dB)
0.	0.00000	-INFINITY	-INFINITY	92.0	0.76774	-1.14787	-6.18012
2.0	0.05454	-12.63293	-17.66518	94.0	0.68721	-1.62911	-6.66136
4.0	0.19932	-7.00456	-12.03681	96.0	0.61260	-2.12820	-7.16045
6.0	0.38554	-4.13927	-9.17151	98.0	0.54290	-2.65281	-7.68506
8.0	0.55399	-2.56499	-7.59724	100.0	0.47721	-3.21294	-8.24519
10.0	0.65720	-1.82302	-6.85527	102.0	0.41488	-3.82076	-8.85301
12.0	0.67467	-1.70906	-6.74131	104.0	0.35563	-4.49004	-9.52229
14.0	0.61533	-2.10891	-7.14116	106.0	0.29960	-5.23464	-10.26689
16.0	0.50815	-2.94012	-7.97237	108.0	0.24746	-6.06500	-11.09724
18.0	0.38709	-4.12192	-9.15417	110.0	0.20042	-6.98054	-12.01279
20.0	0.27813	-5.55750	-10.58975	112.0	0.16017	-7.95420	-12.98645
22.0	0.19374	-7.12781	-12.16006	114.0	0.12866	-8.90573	-13.93798
24.0	0.13559	-8.67770	-13.70995	116.0	0.10778	-9.67468	-14.70692
26.0	0.10225	-9.90340	-14.93565	118.0	0.09892	-10.04737	-15.07962
28.0	0.09667	-10.14694	-15.17919	120.0	0.10237	-9.89846	-14.93071
30.0	0.12950	-8.87719	-13.90944	122.0	0.11683	-9.32434	-14.35659
32.0	0.21686	-6.63830	-11.67055	124.0	0.13910	-8.56684	-13.59909
34.0	0.37418	-4.26922	-9.30147	126.0	0.16407	-7.84978	-12.88203
36.0	0.60933	-2.15148	-7.18372	128.0	0.18540	-7.31883	-12.35107
38.0	0.91792	-0.37196	-5.40421	130.0	0.19673	-7.06133	-12.09358
40.0	1.28256	1.08079	-3.95146	132.0	0.19331	-7.13735	-12.16960
42.0	1.67600	2.24273	-2.78952	134.0	0.17383	-7.59870	-12.63095
44.0	2.06654	3.15244	-1.87980	136.0	0.14156	-8.49071	-13.52296
46.0	2.42406	3.84543	-1.18682	138.0	0.10436	-9.81449	-14.84674
48.0	2.72465	4.35310	-0.67915	140.0	0.07307	-11.36240	-16.39465
50.0	2.95324	4.70299	-0.32926	142.0	0.05820	-12.35071	-17.38296
52.0	3.10400	4.91922	-0.11303	144.0	0.06595	-11.80756	-16.83981
54.0	3.17897	5.02287	-0.00938	146.0	0.09494	-10.22549	-15.25774
56.0	3.18585	5.03225	0.00000	148.0	0.13526	-8.68834	-13.72059
58.0	3.13552	4.96309	-0.06916	150.0	0.17111	-7.66712	-12.69937
60.0	3.03998	4.82870	-0.20355	152.0	0.18671	-7.28826	-12.32051
62.0	2.91082	4.64015	-0.39210	154.0	0.17350	-7.60707	-12.63932
64.0	2.75833	4.40646	-0.62579	156.0	0.13554	-8.67922	-13.71147
66.0	2.59112	4.13488	-0.89737	158.0	0.08993	-10.46080	-15.49305
68.0	2.41613	3.83121	-1.20104	160.0	0.06076	-12.16363	-17.19588
70.0	2.23877	3.50009	-1.53216	162.0	0.06841	-11.64903	-16.68128
72.0	2.06316	3.14533	-1.88692	164.0	0.11861	-9.25891	-14.29116
74.0	1.89242	2.77017	-2.26208	166.0	0.17702	-7.05494	-12.08719
76.0	1.72881	2.37746	-2.65478	168.0	0.27304	-5.63771	-10.66996
78.0	1.57392	1.96982	-3.06242	170.0	0.31249	-5.05161	-10.08386
80.0	1.42878	1.54966	-3.48259	172.0	0.29381	-5.31933	-10.35158
82.0	1.29394	1.11913	-3.91314	174.0	0.21991	-6.57751	-11.60975
84.0	1.16952	0.69008	-4.35217	176.0	0.11908	-9.24176	-14.27401
86.0	1.05532	0.25383	-4.79842	178.0	0.03343	-14.75846	-19.79071
88.0	0.95081	-0.21905	-5.25130	180	0.00000	-INFINITY	-INFINITY
90.0	0.85526	-0.67931	-5.71126				

TABLE A2-47

EPSLN= 11 5000(NORMALIZED GROUNDPLANE RADIUS)
 MONOPOLE LENGTH= 0 250000(WAVELENGTH)
 MONOPOLE RADIUS= 0 1000E-05(WAVELENGTH)
 NUMBER OF MONOPOLE SEGMENTS= 1
 NUMBER OF DISK SEGMENTS= 34
 NUMBER OF ANNULAR ZONES PER DISK SEGMENT= 1
 RADIATION RESISTANCE DETERMINED BY PATTERN= 0 345396E+02 OHMS

ELEVATION ANGLE (DEG)	DIRECTIVITY (NUMERIC)	DIRECTIVITY (dBi)	RELATIVE POWER (dB)	ELEVATION ANGLE (DEG)	DIRECTIVITY (NUMERIC)	DIRECTIVITY (dBi)	RELATIVE POWER (dB)
0	0 00000	-INFINITY	-INFINITY	92 0	0 78459	-1 05356	-5 96640
2 0	0 06109	-12 14065	-17 05348	94 0	0 70818	-1 49859	-6 41142
4 0	0 22270	-6 52286	-11 43570	96 0	0 63811	-1 95106	-6 86389
6 0	0 42909	-3 67450	-8 58733	98 0	0 57312	-2 41756	-7 33040
8 0	0 61348	-2 12201	-7 03484	100 0	0 51197	-2 90755	-7 82039
10 0	0 72383	-1 40363	-6 31646	102 0	0 45358	-3 43350	-8 34633
12 0	0 73976	-1 30909	-6 22192	104 0	0 39712	-4 01078	-8 92361
14 0	0 67407	-1 71297	-6 62580	106 0	0 34220	-4 65715	-9 56998
16 0	0 56061	-2 51343	-7 42626	108 0	0 28898	-5 39132	-10 30415
18 0	0 43639	-3 60124	-8 51408	110 0	0 23826	-6 22941	-11 14224
20 0	0 32728	-4 85084	-9 76368	112 0	0 19157	-7 17674	-12 08957
22 0	0 24312	-6 14173	-11 05457	114 0	0 15103	-8 20946	-13 12229
24 0	0 18257	-7 38576	-12 29859	116 0	0 11914	-9 23933	-14 15217
26 0	0 14273	-8 45473	-13 36757	118 0	0 09836	-10 07184	-14 98468
28 0	0 12762	-8 94081	-13 85365	120 0	0 09045	-10 43612	-15 34896
30 0	0 15077	-8 21686	-13 12969	122 0	0 09579	-10 18688	-15 09971
32 0	0 23144	-6 35569	-11 26852	124 0	0 11276	-9 47861	-14 39144
34 0	0 38677	-4 12548	-9 03831	126 0	0 13736	-8 62126	-13 53410
36 0	0 62402	-2 04799	-6 96082	128 0	0 16350	-7 86484	-12 77767
38 0	0 93616	-0 28652	-5 19935	130 0	0 18388	-7 35467	-12 26750
40 0	1 30223	1 14687	-3 76596	132 0	0 19175	-7 17271	-12 08555
42 0	1 69194	2 28385	-2 62899	134 0	0 18299	-7 37574	-12 28857
44 0	2 07220	3 16432	-1 74851	136 0	0 15806	-8 01187	-12 92470
46 0	2 41349	3 82646	-1 08638	138 0	0 12284	-9 10649	-14 01932
48 0	2 69422	4 30432	-0 60851	140 0	0 08779	-10 56566	-15 47850
50 0	2 90254	4 62778	-0 28506	142 0	0 06493	-11 87573	-16 78856
52 0	3 03580	4 82273	-0 09010	144 0	0 06348	-11 97334	-16 88617
54 0	3 09846	4 91146	-0 00137	146 0	0 08550	-10 68059	-15 59342
56 0	3 09944	4 91283	0 00000	148 0	0 12352	-9 08250	-13 99533
58 0	3 04963	4 84247	-0 07036	150 0	0 16219	-7 89980	-12 81283
60 0	2 96006	4 71300	-0 19983	152 0	0 18386	-7 35506	-12 43700
62 0	2 84075	4 53433	-0 37851	154 0	0 17684	-7 52417	-12 26790
64 0	2 70025	4 31405	-0 59879	156 0	0 14243	-8 46402	-13 37686
66 0	2 54560	4 05790	-0 85494	158 0	0 09694	-10 13479	-15 04762
68 0	2 38246	3 77026	-1 14258	160 0	0 06630	-11 78511	-16 69795
70 0	2 21544	3 45460	-1 45823	162 0	0 07429	-11 29080	-16 20363
72 0	2 04829	3 11391	-1 79893	164 0	0 12957	-8 87510	-13 78794
74 0	1 88405	2 75093	-2 16190	166 0	0 21802	-6 61495	-11 52779
76 0	1 72522	2 36845	-2 54438	168 0	0 30588	-5 14453	-10 05737
78 0	1 57374	1 96934	-2 94350	170 0	0 35362	-4 51458	-9 42741
80 0	1 43106	1 55659	-3 35625	172 0	0 33514	-4 74775	-9 66059
82 0	1 29815	1 13326	-3 77957	174 0	0 25235	-5 97992	-10 89275
84 0	1 17354	0 70234	-4 21048	176 0	0 13721	-8 62603	-13 53887
86 0	1 06330	0 26058	-4 64626	178 0	0 03862	-14 13202	-19 04485
88 0	0 96118	-0 17134	-5 08477	180	0 00000	-INFINITY	-INFINITY
90 0	0 86457	-0 61195	-5 52679				

TABLE A2-48

EPSLN= 11.7500(NORMALIZED GROUNDPLANE RADIUS)
 MONOPOLE LENGTH= 0.250000(WAVELENGTH)
 MONOPOLE RADIUS= 0.1000E-05(WAVELENGTH)
 NUMBER OF MONOPOLE SEGMENTS= 1
 NUMBER OF DISK SEGMENTS= 35
 NUMBER OF ANNUAL ZONES PER DISK SEGMENT= 1
 RADIATION RESISTANCE DETERMINED BY PATTERN= 0.350588E+02 OHMS

ELEVATION ANGLE (DEG)	DIRECTIVITY (NUMERIC)	DIRECTIVITY (dBi)	RELATIVE POWER (dB)	ELEVATION ANGLE (DEG)	DIRECTIVITY (NUMERIC)	DIRECTIVITY (dBi)	RELATIVE POWER (dB)
0.	0.00000	-INFINITY	-INFINITY	92.0	0.77281	-1.11929	-5.91731
2.0	0.06752	-11.70558	-16.50360	94.0	0.69896	-1.55549	-6.35351
4.0	0.24558	-6.09808	-10.89610	96.0	0.63290	-1.98663	-6.78465
6.0	0.47143	-3.26579	-8.06381	98.0	0.57323	-2.41674	-7.21476
8.0	0.67096	-1.73303	-6.53105	100.0	0.51843	-2.85307	-7.65110
10.0	0.78820	-1.03365	-5.83167	102.0	0.46704	-3.30642	-8.10445
12.0	0.80374	-0.94885	-5.74687	104.0	0.41772	-3.79115	-8.58917
14.0	0.73492	-1.33757	-6.13560	106.0	0.36942	-4.32483	-9.12285
16.0	0.62051	-2.07254	-6.87056	108.0	0.32156	-4.92735	-9.72537
18.0	0.49979	-3.01216	-7.81018	110.0	0.27423	-5.61883	-10.41685
20.0	0.39721	-4.00974	-8.80777	112.0	0.22830	-6.41497	-11.21299
22.0	0.31876	-4.96532	-9.76334	114.0	0.18549	-7.31679	-12.11481
24.0	0.25919	-5.86375	-10.66178	116.0	0.14839	-8.28899	-13.08701
26.0	0.21397	-6.69654	-11.49456	118.0	0.11960	-9.22259	-14.02061
28.0	0.18834	-7.25053	-12.04855	120.0	0.10223	-9.90439	-14.70242
30.0	0.19908	-7.00970	-11.80772	122.0	0.09803	-10.08644	-14.88446
32.0	0.26872	-5.70707	-10.50509	124.0	0.10711	-9.70170	-14.49972
34.0	0.41604	-3.80863	-8.60666	126.0	0.12708	-8.95939	-13.75742
36.0	0.64767	-1.88645	-6.68447	128.0	0.15280	-8.15868	-12.95670
38.0	0.95419	-0.20363	-5.00165	130.0	0.17698	-7.52064	-12.31866
40.0	1.31192	1.17909	-3.61894	132.0	0.19160	-7.17593	-11.97395
42.0	1.68880	2.27579	-2.52224	134.0	0.19021	-7.20761	-12.00563
44.0	2.05181	3.12138	-1.67665	136.0	0.17042	-7.68479	-12.48281
46.0	2.37333	3.75357	-1.04445	138.0	0.13570	-8.67409	-13.47211
48.0	2.63481	4.20750	-0.59052	140.0	0.09547	-10.20151	-14.99954
50.0	2.82765	4.51425	-0.28377	142.0	0.06271	-12.02638	-16.82440
52.0	2.95164	4.70063	-0.09739	144.0	0.04955	-13.04961	-17.84763
54.0	3.01240	4.78912	-0.00890	146.0	0.06187	-12.08495	-16.88297
56.0	3.01858	4.79802	0.00000	148.0	0.09560	-10.19559	-14.99362
58.0	2.97965	4.74166	-0.05637	150.0	0.13672	-8.64168	-13.43970
60.0	2.90455	4.63079	-0.16723	152.0	0.16639	-7.78874	-12.58676
62.0	2.80103	4.47318	-0.32484	154.0	0.16966	-7.70412	-12.50214
64.0	2.67563	4.27426	-0.52376	156.0	0.14429	-8.40758	-13.20560
66.0	2.53387	4.03784	-0.76018	158.0	0.10466	-9.80216	-14.60018
68.0	2.38054	3.76676	-1.03126	160.0	0.07743	-11.11103	-15.90905
70.0	2.21994	3.46341	-1.33462	162.0	0.08924	-10.49463	-15.29265
72.0	2.05596	3.13014	-1.66788	164.0	0.15159	-8.19318	-12.99120
74.0	1.89214	2.76953	-2.02849	166.0	0.25092	-6.00465	-10.80267
76.0	1.73161	2.38450	-2.41353	168.0	0.35049	-4.55321	-9.35123
78.0	1.57702	1.97838	-2.81964	170.0	0.40555	-3.91956	-8.71758
80.0	1.43051	1.55492	-3.24310	172.0	0.38534	-4.14153	-8.93955
82.0	1.29366	1.11819	-3.67983	174.0	0.29096	-5.36165	-10.15967
84.0	1.16748	0.67249	-4.12553	176.0	0.15857	-7.99787	-12.79589
86.0	1.05248	0.22213	-4.57589	178.0	0.04459	-13.49750	-18.29552
88.0	0.94868	-0.22879	-5.02681	180.0	0.00000	-INFINITY	-INFINITY
90.0	0.85571	-0.67676	-5.47478				

TABLE A2-49

EPSLN= 12.0000(NORMALIZED GROUNDPLANE RADIUS)
 MONOPOLE LENGTH= 0.25000(WAVELENGTH)
 MONOPOLE RADIUS= 0.1000E-05(WAVELENGTH)
 NUMBER OF MONOPOLE SEGMENTS= 1
 NUMBER OF DISK SEGMENTS= 36
 NUMBER OF ANNULAR ZONES PER DISK SEGMENT= 1
 RADIATION RESISTANCE DETERMINED BY PATTERN= 0.344984E+02 OHMS

ELEVATION ANGLE (DEG)	DIRECTIVITY (NUMERIC)	DIRECTIVITY (dBi)	RELATIVE POWER (dB)	ELEVATION ANGLE (DEG)	DIRECTIVITY (NUMERIC)	DIRECTIVITY (dBi)	RELATIVE POWER (dB)
0.	0.00000	-INFINITY	-INFINITY	92.0	0.78616	-1.04490	-5.70038
2.0	0.07468	-11.26769	-15.92317	94.0	0.71317	-1.46808	-6.12356
4.0	0.27028	-5.68194	-10.33742	96.0	0.64933	-1.87534	-6.53082
6.0	0.51449	-2.88621	-7.54169	98.0	0.59310	-2.26875	-6.92423
8.0	0.72363	-1.40482	-6.06031	100.0	0.54273	-2.65415	-7.30963
10.0	0.83747	-0.77030	-5.42578	102.0	0.49640	-3.04171	-7.69719
12.0	0.83969	-0.75879	-5.41428	104.0	0.45226	-3.44615	-8.10163
14.0	0.75578	-1.21607	-5.87155	106.0	0.40863	-3.88674	-8.54222
16.0	0.63273	-1.98778	-6.64327	108.0	0.36417	-4.38691	-9.04239
18.0	0.51373	-2.89268	-7.54816	110.0	0.31817	-4.97346	-9.62894
20.0	0.42103	-3.75690	-8.41238	112.0	0.27072	-5.67484	-10.33032
22.0	0.35421	-4.50743	-9.16291	114.0	0.22300	-6.51698	-11.17246
24.0	0.30116	-5.21205	-9.86753	116.0	0.17732	-7.51231	-12.16779
26.0	0.25339	-5.96210	-10.61758	118.0	0.13701	-8.63261	-13.28809
28.0	0.21643	-6.64682	-11.30230	120.0	0.10590	-9.75091	-14.40639
30.0	0.21046	-6.76835	-11.42383	122.0	0.08763	-10.57336	-15.22884
32.0	0.26218	-5.81401	-10.46949	124.0	0.08451	-10.73116	-15.38664
34.0	0.39312	-4.03480	-8.71028	126.0	0.09642	-10.15943	-14.81391
36.0	0.61023	-2.14508	-6.80057	128.0	0.12005	-9.20453	-13.86201
38.0	0.90265	-0.44483	-5.10031	130.0	0.14879	-8.27420	-12.92968
40.0	1.24486	0.95121	-3.70427	132.0	0.17384	-7.59853	-12.25402
42.0	1.60408	2.05225	-2.60323	134.0	0.18638	-7.29595	-11.95143
44.0	1.94833	2.89663	-1.75885	136.0	0.18063	-7.43221	-12.08769
46.0	2.25265	3.52693	-1.12855	138.0	0.15656	-8.05317	-12.70865
48.0	2.50181	3.98255	-0.67293	140.0	0.12123	-9.16373	-13.81921
50.0	2.69009	4.29766	-0.35782	142.0	0.08735	-10.58722	-15.24270
52.0	2.81884	4.50070	-0.15478	144.0	0.06895	-11.61450	-16.26998
54.0	2.89333	4.61428	-0.04120	146.0	0.07527	-11.23360	-15.88909
56.0	2.92111	4.65548	0.00000	148.0	0.10537	-9.77280	-14.42828
58.0	2.90833	4.63643	-0.01903	150.0	0.14654	-8.34037	-12.99586
60.0	2.86099	4.56517	-0.09031	152.0	0.17859	-7.48133	-12.13681
62.0	2.78401	4.44670	-0.20878	154.0	0.18334	-7.36733	-12.02281
64.0	2.68168	4.28407	-0.37141	156.0	0.15547	-8.08340	-12.73888
66.0	2.55817	4.07930	-0.57618	158.0	0.10883	-9.63248	-14.28796
68.0	2.41774	3.83409	-0.82139	160.0	0.07319	-11.35556	-16.01104
70.0	2.26483	3.55036	-1.10512	162.0	0.08083	-10.92438	-15.57986
72.0	2.10400	3.23046	-1.42502	164.0	0.14826	-8.28983	-12.94531
74.0	1.93971	2.87736	-1.7812	166.0	0.26275	-5.80460	-10.46008
76.0	1.77608	2.49462	-2.16086	168.0	0.38272	-4.17123	-8.82671
78.0	1.61675	2.08644	-2.56904	170.0	0.45459	-3.42380	-8.07928
80.0	1.46471	1.65753	-2.99793	172.0	0.43943	-3.57107	-8.22655
82.0	1.32223	1.21308	-3.44240	174.0	0.33564	-4.74126	-9.39674
84.0	1.19037	0.75865	-3.89683	176.0	0.18428	-7.34523	-12.00071
86.0	1.07153	0.30006	-4.35842	178.0	0.05216	-12.82667	-17.48215
88.0	0.96451	-0.15691	-4.81239	180.0	0.00000	-INFINITY	-INFINITY
90.0	0.86940	-0.66678	-5.26326				

TABLE A2-50

EPSLN= 12 2500(NORMALIZED GROUNDPLANE RADIUS)
 MONOPOLE LENGTH= 0.25000(WAVELENGTH)
 MONOPOLE RADIUS= 0.1000E-05(WAVELENGTH)
 NUMBER OF MONOPOLE SEGMENTS= 1
 NUMBER OF DISK SEGMENTS= 36
 NUMBER OF ANNULAR ZONES PER DISK SEGMENT= 1
 RADIATION RESISTANCE DETERMINED BY PATTERN= 0.350058E+02 OHMS

ELEVATION ANGLE (DEG)	DIRECTIVITY (NUMERIC)	DIRECTIVITY (dBi)	RELATIVE POWER (dB)	ELEVATION ANGLE (DEG)	DIRECTIVITY (NUMERIC)	DIRECTIVITY (dBi)	RELATIVE POWER (dB)
0	0.00000	-INFINITY	-INFINITY	92.0	0.76992	-1.13553	-5.73212
2.0	0.08047	-10.94356	-15.54015	94.0	0.69516	-1.57916	-6.15755
4.0	0.28973	-5.38000	-9.97658	96.0	0.63147	-1.99649	-6.59307
6.0	0.54683	-2.62147	-7.21805	98.0	0.57733	-2.38578	-6.98237
8.0	0.75999	-1.19192	-5.78850	100.0	0.53096	-2.74939	-7.34597
10.0	0.86667	-0.62144	-5.21802	102.0	0.49038	-3.09468	-7.69126
12.0	0.85944	-0.67811	-5.27469	104.0	0.45345	-3.43469	-8.03127
14.0	0.76077	-1.18745	-5.78404	106.0	0.41801	-3.78818	-8.38476
16.0	0.63743	-1.95568	-6.55227	108.0	0.38201	-4.17924	-8.77582
18.0	0.53063	-2.75206	-7.34865	110.0	0.34383	-4.63651	-9.23309
20.0	0.45815	-3.38996	-7.98655	112.0	0.30255	-5.19202	-9.78860
22.0	0.41116	-3.85994	-8.45652	114.0	0.25828	-5.87904	-10.47562
24.0	0.36966	-4.32193	-8.91851	116.0	0.21247	-6.72693	-11.32351
26.0	0.32120	-4.93221	-9.52879	118.0	0.16798	-7.74733	-12.34391
28.0	0.27208	-5.65297	-10.24956	120.0	0.12886	-8.89867	-13.49526
30.0	0.24641	-6.08344	-10.68002	122.0	0.09973	-10.01181	-14.60840
32.0	0.27526	-5.60259	-10.19917	124.0	0.08467	-10.72259	-15.31917
34.0	0.38290	-4.16916	-8.76574	126.0	0.08591	-10.65932	-15.25591
36.0	0.57688	-2.38912	-6.98570	128.0	0.10249	-9.89317	-14.48976
38.0	0.84570	-0.72783	-5.32441	130.0	0.12952	-8.87668	-13.47327
40.0	1.16349	0.65764	-3.93894	132.0	0.15860	-7.99700	-12.59358
42.0	1.49855	1.75670	-2.83988	134.0	0.17967	-7.45525	-12.05184
44.0	1.82159	2.60452	-1.95207	136.0	0.18416	-7.34810	-11.94468
46.0	2.11123	3.24536	-1.35122	138.0	0.16856	-7.73237	-12.32915
48.0	2.35551	3.72085	-0.87573	140.0	0.13694	-8.63466	-13.23124
50.0	2.55049	4.06623	-0.53035	142.0	0.10085	-9.96338	-14.55996
52.0	2.69732	4.30932	-0.28726	144.0	0.07559	-11.21538	-15.81196
54.0	2.79931	4.47050	-0.12608	146.0	0.07373	-11.32335	-15.91993
56.0	2.85989	4.56349	-0.03310	148.0	0.09821	-10.07859	-14.67517
58.0	2.88176	4.59658	0.00000	150.0	0.13876	-8.57724	-13.17382
60.0	2.86700	4.57428	-0.02230	152.0	0.17487	-7.57291	-12.16949
62.0	2.81760	4.49879	-0.09779	154.0	0.18531	-7.32096	-11.91755
64.0	2.73611	4.37134	-0.22524	156.0	0.16090	-7.93432	-12.53090
66.0	2.62606	4.19305	-0.40353	158.0	0.11341	-9.45354	-14.05012
68.0	2.49202	3.96551	-0.63108	160.0	0.07414	-11.29959	-15.89617
70.0	2.33937	3.69098	-0.90560	162.0	0.08011	-10.96340	-15.55999
72.0	2.17396	3.37251	-1.22407	164.0	0.15291	-8.15577	-12.75236
74.0	2.00163	3.01384	-1.58274	166.0	0.28151	-5.50513	-10.10171
76.0	1.82783	2.61935	-1.97723	168.0	0.42044	-3.76297	-8.35955
78.0	1.65729	2.19399	-2.40259	170.0	0.50790	-2.94218	-7.53877
80.0	1.49389	1.74318	-2.85340	172.0	0.49681	-3.03808	-7.63466
82.0	1.34055	1.27284	-3.32374	174.0	0.38263	-4.17224	-8.76882
84.0	1.19932	0.78935	-3.80723	176.0	0.21125	-6.75213	-11.34871
86.0	1.07140	0.29953	-4.29705	178.0	0.05998	-12.21969	-16.81627
88.0	0.95732	-0.18944	-4.78602	180	0.00000	-INFINITY	-INFINITY
90.0	0.85700	-0.67018	-5.26677				

TABLE A2-51

EPSLN= 12 5000(NORMALIZED GROUNDPLANE RADIUS)
 MONOPOLE LENGTH= 0 250000(WAVELENGTH)
 MONOPOLE RADIUS= 0 1000E-05(WAVELENGTH)
 NUMBER OF MONOPOLE SEGMENTS= 1
 NUMBER OF DISK SEGMENTS= 37
 NUMBER OF ANNUAL ZONES PER DISK SEGMENT= 1
 RADIATION RESISTANCE DETERMINED BY PATTERN= 0 357880E+02 OHMS

ELEVATION ANGLE (DEG)	DIRECTIVITY (NUMERIC)	DIRECTIVITY (dBi)	RELATIVE POWER (dB)	ELEVATION ANGLE (DEG)	DIRECTIVITY (NUMERIC)	DIRECTIVITY (dBi)	RELATIVE POWER (dB)
0	0.00000	-INFINITY	-INFINITY	92.0	0.74565	-1.27467	-5.92308
2.0	0.08453	-10.73005	-15.37846	94.0	0.66700	-1.75877	-6.40718
4.0	0.30246	-5.19325	-9.84166	96.0	0.60119	-2.20988	-6.85829
6.0	0.56492	-2.48016	-7.12857	98.0	0.54683	-2.62145	-7.26986
8.0	0.77354	-1.11518	-5.76359	100.0	0.50227	-2.99061	-7.63902
10.0	0.86566	-0.62655	-5.27496	102.0	0.46558	-3.32001	-7.96842
12.0	0.83693	-0.77309	-5.42150	104.0	0.43459	-3.61919	-8.26760
14.0	0.73229	-1.35317	-6.00158	106.0	0.40690	-3.90515	-8.53556
16.0	0.61413	-2.11737	-6.76578	108.0	0.38001	-4.20201	-8.85042
18.0	0.52818	-2.77221	-7.42062	110.0	0.35157	-4.53992	-9.18833
20.0	0.48529	-3.13994	-7.78835	112.0	0.31962	-4.95360	-9.60201
22.0	0.46612	-3.31504	-7.96345	114.0	0.28310	-5.48060	-10.12901
24.0	0.44149	-3.55084	-8.19925	116.0	0.24219	-6.15837	-10.80678
26.0	0.39469	-4.03745	-8.68586	118.0	0.19872	-7.01750	-11.66591
28.0	0.33318	-4.77321	-9.42162	120.0	0.15621	-8.06288	-12.71129
30.0	0.28543	-5.44496	-10.09337	122.0	0.11952	-9.22560	-13.87401
32.0	0.28719	-5.41824	-10.06665	124.0	0.09395	-10.27108	-14.91949
34.0	0.36572	-4.36846	-9.01687	126.0	0.08380	-10.76742	-15.41583
36.0	0.52970	-2.75969	-7.40810	128.0	0.09071	-10.42333	-15.07174
38.0	0.76804	-1.14615	-5.79456	130.0	0.11224	-9.49850	-14.14691
40.0	1.03606	0.23690	-4.41151	132.0	0.14147	-8.49343	-13.14184
42.0	1.36473	1.35045	-3.29796	134.0	0.16817	-7.74243	-12.39084
44.0	1.68861	2.22356	-2.42485	136.0	0.18178	-7.40453	-12.05294
46.0	1.95017	2.90073	-1.74768	138.0	0.17543	-7.59744	-12.20744
48.0	2.19997	3.42417	-1.22424	140.0	0.14967	-8.24860	-12.89701
50.0	2.41434	3.82798	-0.82043	142.0	0.11384	-9.43708	-14.08549
52.0	2.59229	4.13683	-0.51158	144.0	0.08347	-10.78493	-15.43334
54.0	2.73312	4.36659	-0.28182	146.0	0.07383	-11.31743	-15.96584
56.0	2.83539	4.52613	-0.12228	148.0	0.09187	-10.36830	-15.01671
58.0	2.89704	4.61955	-0.02886	150.0	0.13052	-8.84337	-13.49178
60.0	2.91636	4.64841	0.00000	152.0	0.16976	-7.70161	-12.35002
62.0	2.89293	4.61338	-0.03503	154.0	0.18583	-7.30891	-11.95732
64.0	2.82836	4.51534	-0.13307	156.0	0.16538	-7.81513	-12.46354
66.0	2.72644	4.35596	-0.29245	158.0	0.11731	-9.30654	-13.95495
68.0	2.59288	4.13782	-0.51059	160.0	0.07372	-11.32421	-15.97262
70.0	2.43468	3.86443	-0.78398	162.0	0.07621	-11.17975	-15.82816
72.0	2.25943	3.53959	-1.10842	164.0	0.15214	-8.17754	-12.82595
74.0	2.07458	3.16930	-1.47911	166.0	0.29325	-5.32759	-9.97600
76.0	1.88693	2.75755	-1.89086	168.0	0.45101	-3.45811	-8.10652
78.0	1.70226	2.31027	-2.33814	170.0	0.55542	-2.55375	-7.20216
80.0	1.52520	1.83327	-2.81514	172.0	0.55052	-2.59226	-7.24067
82.0	1.35915	1.33268	-3.31573	174.0	0.42789	-3.68670	-8.33511
84.0	1.20644	0.81505	-3.83336	176.0	0.23767	-6.24029	-10.88870
86.0	1.06842	0.28743	-4.36093	178.0	0.06772	-11.69277	-16.34118
88.0	0.94570	-0.24245	-4.89086	180	0.00000	-INFINITY	-INFINITY
90.0	0.83827	-0.76416	-5.41457				

TABLE A2-52

EPSLN= 12 7500(NORMALIZED GROUNDPLANE RADIUS)
 MONOPOLE LENGTH= 0.250000(WAVELENGTH)
 MONOPOLE RADIUS= 0.1000E-03(WAVELENGTH)
 NUMBER OF MONOPOLE SEGMENTS= 1
 NUMBER OF DISK SEGMENTS= 38
 NUMBER OF ANNULAR ZONES PER DISK SEGMENT= 1
 RADIATION RESISTANCE DETERMINED BY PATTERN= 0.366734E+02 OHMS

ELEVATION ANGLE (DEG)	DIRECTIVITY (NUMERIC)	DIRECTIVITY (dBi)	RELATIVE POWER (dB)	ELEVATION ANGLE (DEG)	DIRECTIVITY (NUMERIC)	DIRECTIVITY (dBi)	RELATIVE POWER (dB)
0.	0.00000	-INFINITY	-INFINITY	92.0	0.71920	-1.43153	-6.20237
2.0	0.08672	-10.61894	-15.38977	94.0	0.63544	-1.96924	-6.74007
4.0	0.30807	-5.11352	-9.88436	96.0	0.56577	-2.47361	-7.24445
6.0	0.56827	-2.45444	-7.22527	98.0	0.50898	-2.93303	-7.70387
8.0	0.76421	-1.16785	-5.93868	100.0	0.46366	-3.33804	-8.10888
10.0	0.83532	-0.78145	-5.55228	102.0	0.42815	-3.68406	-8.45489
12.0	0.78636	-1.04377	-5.81460	104.0	0.40049	-3.97411	-8.74495
14.0	0.67358	-1.71613	-6.48697	106.0	0.37837	-4.22082	-8.99165
16.0	0.56641	-2.46872	-7.23956	108.0	0.35919	-4.44670	-9.21754
18.0	0.50921	-2.93106	-7.70190	110.0	0.34018	-4.68296	-9.45380
20.0	0.50376	-2.97777	-7.74861	112.0	0.31863	-4.96719	-9.73803
22.0	0.51849	-2.85260	-7.62344	114.0	0.29235	-5.34093	-10.11176
24.0	0.51447	-2.88639	-7.65722	116.0	0.26019	-5.84706	-10.61790
26.0	0.47102	-3.26958	-8.04042	118.0	0.22254	-6.52588	-11.29672
28.0	0.39730	-4.00883	-8.77967	120.0	0.18175	-7.40520	-12.17604
30.0	0.32652	-4.86089	-9.63173	122.0	0.14213	-8.47316	-13.24400
32.0	0.29917	-5.24084	-10.01168	124.0	0.10935	-9.61178	-14.38261
34.0	0.34554	-4.61499	-9.38582	126.0	0.08918	-10.49717	-15.26800
36.0	0.47588	-3.22505	-7.99589	128.0	0.08564	-10.67307	-15.44391
38.0	0.68050	-1.67172	-6.44256	130.0	0.09907	-10.04065	-14.81149
40.0	0.93725	-0.28144	-5.05227	132.0	0.12487	-9.03553	-13.80636
42.0	1.22099	0.86713	-3.90371	134.0	0.15380	-8.13031	-12.90114
44.0	1.51072	1.79185	-2.97899	136.0	0.17437	-7.58536	-12.35620
46.0	1.79238	2.53429	-2.23654	138.0	0.17693	-7.52196	-12.29280
48.0	2.05779	3.13401	-1.63682	140.0	0.15840	-8.00233	-12.77316
50.0	2.30180	3.62068	-1.15016	142.0	0.12510	-9.02730	-13.79813
52.0	2.51951	4.01315	-0.75768	144.0	0.09168	-10.37743	-15.14826
54.0	2.70485	4.32144	-0.44940	146.0	0.07525	-11.23510	-16.00593
56.0	2.85084	4.54972	-0.22111	148.0	0.08652	-10.62870	-15.39954
58.0	2.95075	4.69933	-0.07151	150.0	0.12216	-9.13079	-13.90162
60.0	2.99974	4.77084	0.00000	152.0	0.16356	-7.86329	-12.63413
62.0	2.99599	4.76540	-0.00544	154.0	0.18503	-7.32760	-12.09844
64.0	2.94122	4.68528	-0.08556	156.0	0.16906	-7.71949	-12.49033
66.0	2.84046	4.53389	-0.23694	158.0	0.12094	-9.17433	-13.94517
68.0	2.70126	4.31567	-0.45517	160.0	0.07260	-11.39064	-16.16147
70.0	2.53264	4.03573	-0.73510	162.0	0.06981	-11.56094	-16.33178
72.0	2.34405	3.69967	-1.07116	164.0	0.14610	-8.35363	-13.12447
74.0	2.14452	3.31331	-1.45753	166.0	0.29711	-5.27080	-10.04164
76.0	1.94201	2.88232	-1.88832	168.0	0.47241	-3.25678	-8.02762
78.0	1.74308	2.41317	-2.35767	170.0	0.59431	-2.25986	-7.03069
80.0	1.55278	1.91110	-2.85973	172.0	0.59760	-2.23586	-7.00670
82.0	1.37474	1.38221	-3.36863	174.0	0.46908	-3.28753	-8.05837
84.0	1.21131	0.83225	-3.93825	176.0	0.26224	-5.81301	-10.58384
86.0	1.06380	0.26861	-4.50423	178.0	0.07500	-11.24944	-16.02028
88.0	0.93274	-0.30242	-5.07325	180	0.00000	-INFINITY	-INFINITY
90.0	0.81803	-0.87230	-5.64314				

TABLE A2-53

EPSLN= 13 0000(NORMALIZED GROUNDPLANE RADIUS)
 MONOPOLE LENGTH= 0 250000(WAVELENGTH)
 MONOPOLE RADIUS= 0 1000E-05(WAVELENGTH)
 NUMBER OF MONOPOLE SEGMENTS= 1
 NUMBER OF DISK SEGMENTS= 39
 NUMBER OF ANNULAR ZONES PER DISK SEGMENT= 1
 RADIATION RESISTANCE DETERMINED BY PATTERN= 0 374754E+02 OHMS

ELEVATION ANGLE (DEG)	DIRECTIVITY (NUMERIC)	DIRECTIVITY (dBi)	RELATIVE POWER (dB)	ELEVATION ANGLE (DEG)	DIRECTIVITY (NUMERIC)	DIRECTIVITY (dBi)	RELATIVE POWER (dB)
0.	0.00000	-INFINITY	-INFINITY	92.0	0.69633	-1.57184	-6.49322
2.0	0.08752	-10.57877	-15.50015	94.0	0.60762	-2.16371	-7.08509
4.0	0.30839	-5.10901	-10.03039	96.0	0.53347	-2.72889	-7.65027
6.0	0.56076	-2.51220	-7.43358	98.0	0.47290	-3.25229	-8.17367
8.0	0.73821	-1.31818	-6.23956	100.0	0.42480	-3.71815	-8.63953
10.0	0.78407	-1.05646	-5.97784	102.0	0.38788	-4.11304	-9.03442
12.0	0.71367	-1.46500	-6.38638	104.0	0.36057	-4.43008	-9.35146
14.0	0.59507	-2.25433	-7.17571	106.0	0.34094	-4.67319	-9.59457
16.0	0.50388	-2.97674	-7.89812	108.0	0.32662	-4.85963	-9.78101
18.0	0.48133	-3.17556	-8.09694	110.0	0.31480	-5.01967	-9.94105
20.0	0.51832	-2.85398	-7.77536	112.0	0.30244	-5.19360	-10.11498
22.0	0.57009	-2.44060	-7.36198	114.0	0.28657	-5.42770	-10.34908
24.0	0.58800	-2.30625	-7.22763	116.0	0.26482	-5.77051	-10.69189
26.0	0.54817	-2.61085	-8.27253	118.0	0.23608	-6.26932	-11.19070
28.0	0.46226	-3.35114	-9.25592	120.0	0.20117	-6.96441	-11.88579
30.0	0.36859	-4.33454	-9.97569	122.0	0.16316	-7.87396	-12.79534
32.0	0.31230	-5.05431	-9.78165	124.0	0.12726	-8.95292	-13.87430
34.0	0.32657	-4.86027	-8.65407	126.0	0.09989	-10.00489	-14.92627
36.0	0.42338	-3.73269	-7.17530	128.0	0.08684	-10.61262	-15.53400
38.0	0.59513	-2.25392	-5.76730	130.0	0.09113	-10.40342	-15.32480
40.0	0.82302	-0.84592	-4.56156	132.0	0.11093	-9.54937	-14.47075
42.0	1.08638	0.35982	-3.58881	134.0	0.13894	-8.57177	-13.49315
44.0	1.36854	1.36257	-2.72552	136.0	0.16380	-7.85679	-12.77817
46.0	1.65801	2.19586	-2.02902	138.0	0.17402	-7.59399	-12.51537
48.0	1.94642	2.89236	-1.44703	140.0	0.16314	-7.87452	-12.79590
50.0	2.22554	3.47435	-0.96758	142.0	0.13402	-8.72816	-13.64954
52.0	2.48531	3.95380	-0.58564	144.0	0.09952	-10.02093	-14.94231
54.0	2.71378	4.33574	-0.29950	146.0	0.07764	-11.09891	-16.02029
56.0	2.89860	4.62188	-0.10806	148.0	0.08243	-10.83923	-15.76061
58.0	3.02923	4.81332	-0.00935	150.0	0.11449	-9.41246	-14.33384
60.0	3.09887	4.91203	0.00000	152.0	0.14449	-8.03061	-12.95199
62.0	3.10555	4.92138	-0.07527	154.0	0.15738	-7.34791	-12.26529
64.0	3.05218	4.84611	-0.22938	156.0	0.18417	-7.61310	-12.53448
66.0	2.94578	4.69201	-0.45584	158.0	0.17326	-9.00726	-13.92864
68.0	2.79611	4.46554	-0.74785	160.0	0.12568	-11.40887	-16.33025
70.0	2.61428	4.17353	-1.09858	162.0	0.07230	-12.04469	-16.96607
72.0	2.41146	3.82280	-1.50132	164.0	0.06245	-8.65916	-13.58054
74.0	2.19789	3.42006	-1.94968	166.0	0.13617	-5.31497	-10.23635
76.0	1.98230	2.97170	-2.43764	168.0	0.29411	-3.14123	-8.06261
78.0	1.77163	2.48374	-2.95932	170.0	0.48515	-2.04388	-6.96526
80.0	1.57104	1.96184	-3.50493	172.0	0.62461	-1.95295	-6.87433
82.0	1.38403	1.41145	-4.08362	174.0	0.63783	-2.95922	-7.88060
84.0	1.21276	0.83772	-4.67521	176.0	0.50592	-5.45503	-10.37641
86.0	1.05832	0.24617	-5.27882	178.0	0.28477	-10.87459	-15.79597
88.0	0.92099	-0.35744	-5.88763	180.0	0.08176	-INFINITY	-INFINITY
90.0	0.80053	-0.95525			0.00000		

TABLE A2-54

EPSLN= 13 2500(NORMALIZED GROUNDPLANE RADIUS)
 MONOPOLE LENGTH= 0 250000(WAVELENGTH)
 MONOPOLE RADIUS= 0 1000E-05(WAVELENGTH)
 NUMBER OF MONOPOLE SEGMENTS= 1
 NUMBER OF DISK SEGMENTS= 39
 NUMBER OF ANNUAL ZONES PER DISK SEGMENT= 1
 RADIATION RESISTANCE DETERMINED BY PATTERN= 0 380403E+02 OHMS

ELEVATION ANGLE (DEG)	DIRECTIVITY (NUMERIC)	DIRECTIVITY (dBi)	RELATIVE POWER (dB)	ELEVATION ANGLE (DEG)	DIRECTIVITY (NUMERIC)	DIRECTIVITY (dBi)	RELATIVE POWER (dB)
0.	0.00000	-INFINITY	-INFINITY	92.0	0.68078	-1.66996	-6.72608
2.0	0.08791	-10.55976	-15.61588	94.0	0.58814	-2.30520	-7.36132
4.0	0.30696	-5.12914	-10.18526	96.0	0.50986	-2.92548	-7.98160
6.0	0.54930	-2.60190	-7.65802	98.0	0.44511	-3.51537	-8.57150
8.0	0.70564	-1.51419	-6.57031	100.0	0.39304	-4.05567	-9.11179
10.0	0.72419	-1.40147	-6.45759	102.0	0.35276	-4.52522	-9.58134
12.0	0.63196	-1.99311	-7.04923	104.0	0.32319	-4.90541	-9.96153
14.0	0.50920	-2.93115	-7.98727	106.0	0.30292	-5.18670	-10.24282
16.0	0.43713	-3.59394	-8.45006	108.0	0.29006	-5.37505	-10.43117
18.0	0.45251	-3.44368	-8.49980	110.0	0.28217	-5.49488	-10.55100
20.0	0.53407	-2.72405	-7.78017	112.0	0.27625	-5.58699	-10.64311
22.0	0.62329	-2.05313	-7.10925	114.0	0.26898	-5.70277	-10.75889
24.0	0.64230	-1.78942	-6.84554	116.0	0.25717	-5.89787	-10.95399
26.0	0.62503	-2.04097	-7.09709	118.0	0.23839	-6.22712	-11.28324
28.0	0.52654	-2.78572	-7.84184	120.0	0.21184	-6.73999	-11.79611
30.0	0.41061	-3.86575	-8.92187	122.0	0.17899	-7.47164	-12.52776
32.0	0.32688	-4.85613	-9.91225	124.0	0.14394	-8.41822	-13.47434
34.0	0.31116	-5.07011	-10.12623	126.0	0.11287	-9.47435	-14.53047
36.0	0.37714	-4.23497	-9.29110	128.0	0.09262	-10.33309	-15.38921
38.0	0.51952	-2.84396	-7.90009	130.0	0.08837	-10.53690	-15.59302
40.0	0.72321	-1.40734	-6.46346	132.0	0.10112	-9.95157	-15.00770
42.0	0.97200	-0.12332	-5.17944	134.0	0.12602	-8.99553	-14.05165
44.0	1.25292	0.97924	-4.07689	136.0	0.15282	-8.15812	-13.21424
46.0	1.55592	1.91987	-3.13625	138.0	0.18906	-7.71950	-12.77562
48.0	1.87108	2.72092	-2.33520	140.0	0.16547	-7.81283	-12.86895
50.0	2.18595	3.39640	-1.65973	142.0	0.14141	-8.49522	-13.55134
52.0	2.48478	3.95288	-1.10325	144.0	0.10728	-9.69496	-14.75109
54.0	2.74991	4.39319	-0.66293	146.0	0.08118	-10.90548	-15.96160
56.0	2.96453	4.71956	-0.33656	148.0	0.07995	-10.97205	-16.02817
58.0	3.11551	4.93530	-0.12083	150.0	0.10819	-9.65804	-14.71417
60.0	3.19546	5.04533	-0.01079	152.0	0.15216	-8.17693	-13.23305
62.0	3.20341	5.05612	0.00000	154.0	0.18426	-7.34577	-12.40189
64.0	3.14427	4.97520	-0.08092	156.0	0.17890	-7.47380	-12.52992
66.0	3.02741	4.81072	-0.24540	158.0	0.13240	-8.78102	-13.83714
68.0	2.86487	4.57105	-0.48507	160.0	0.07374	-11.32277	-16.37889
70.0	2.66958	4.26443	-0.79169	162.0	0.03543	-12.56242	-17.61854
72.0	2.45401	3.89876	-1.15737	164.0	0.12432	-9.05467	-14.11079
74.0	2.22914	3.48136	-1.57474	166.0	0.28702	-5.42088	-10.47701
76.0	2.00404	3.01906	-2.03706	168.0	0.49277	-3.07351	-8.12964
78.0	1.78562	2.51789	-2.53823	170.0	0.65025	-1.86921	-6.92533
80.0	1.57882	1.98332	-3.07280	172.0	0.67485	-1.70794	-6.76406
82.0	1.38682	1.42020	-3.63592	174.0	0.54114	-2.66691	-7.72303
84.0	1.21142	0.83294	-4.22318	176.0	0.30676	-5.13197	-10.18810
86.0	1.05334	0.22569	-4.83043	178.0	0.08843	-10.53411	-15.59023
88.0	0.91258	-0.39731	-5.45343	180	0.00000	-INFINITY	-INFINITY
90.0	0.78844	-1.03123	-6.06735				

TABLE A2-55

EPSLN= 13 5000(NORMALIZED GROUNDPLANE RADIUS)
 MONOPOLE LENGTH= 0.250000(WAVELENGTH)
 MONOPOLE RADIUS= 0.1000E-05(WAVELENGTH)
 NUMBER OF MONOPOLE SEGMENTS= 1
 NUMBER OF DISK SEGMENTS= 40
 NUMBER OF ANNULAR ZONES PER DISK SEGMENT= 1
 RADIATION RESISTANCE DETERMINED BY PATTERN= 0.383927E+02 OHMS

ELEVATION ANGLE (DEG)	DIRECTIVITY (NUMERIC)	DIRECTIVITY (dBi)	RELATIVE POWER (dB)	ELEVATION ANGLE (DEG)	DIRECTIVITY (NUMERIC)	DIRECTIVITY (dBi)	RELATIVE POWER (dB)
0.	0.00000	-INFINITY	-INFINITY	92.0	0.67197	-1.72652	-6.88397
2.0	0.08912	-10.50009	-15.65753	94.0	0.57709	-2.38759	-7.54504
4.0	0.30827	-5.11062	-10.26807	96.0	0.49587	-3.04632	-8.20377
6.0	0.54226	-2.65789	-7.81533	98.0	0.42756	-3.69003	-8.84748
8.0	0.67801	-1.68766	-6.84510	100.0	0.37152	-4.30017	-9.45762
10.0	0.68871	-1.74762	-6.90506	102.0	0.32718	-4.85211	-10.00956
12.0	0.55398	-2.56506	-7.72251	104.0	0.29392	-5.31776	-10.47520
14.0	0.42723	-3.69336	-8.85081	106.0	0.27088	-5.67227	-10.82971
16.0	0.37539	-4.25512	-9.41257	108.0	0.25679	-5.90415	-11.06159
18.0	0.42995	-3.66583	-8.82327	110.0	0.24979	-6.02428	-11.18172
20.0	0.55632	-2.54676	-7.70421	112.0	0.24727	-6.06834	-11.22579
22.0	0.68175	-1.66375	-6.82120	114.0	0.24598	-6.09108	-11.24852
24.0	0.73953	-1.31046	-6.46790	116.0	0.24230	-6.15638	-11.31383
26.0	0.70241	-1.53408	-6.69152	118.0	0.23289	-6.32856	-11.48601
28.0	0.58992	-2.29204	-7.44949	120.0	0.21546	-6.66639	-11.82383
30.0	0.45186	-3.44991	-8.60736	122.0	0.18980	-7.21693	-12.37438
32.0	0.34236	-4.65521	-9.81266	124.0	0.15847	-8.00050	-13.15795
34.0	0.29952	-5.23575	-10.39319	126.0	0.12679	-8.96912	-14.12657
36.0	0.33848	-4.70470	-9.86215	128.0	0.10188	-9.91917	-15.07662
38.0	0.45616	-3.40885	-8.56630	130.0	0.09048	-10.43448	-15.59192
40.0	0.64101	-1.93134	-7.08879	132.0	0.09613	-10.17152	-15.32897
42.0	0.88086	-0.55094	-5.70838	134.0	0.11666	-9.33076	-14.48821
44.0	1.16559	0.66547	-4.49197	136.0	0.14355	-8.43008	-13.58753
46.0	1.48551	1.71875	-3.43870	138.0	0.16416	-7.84729	-13.00473
48.0	1.82806	2.61992	-2.53753	140.0	0.16703	-7.77218	-12.92963
50.0	2.17598	3.37655	-1.78090	142.0	0.14816	-8.29268	-13.45013
52.0	2.50783	3.99299	-1.16446	144.0	0.11520	-9.38541	-14.54286
54.0	2.80096	4.47307	-0.68437	146.0	0.08579	-10.66581	-15.82326
56.0	3.03521	4.82189	-0.33555	148.0	0.07911	-11.01764	-16.17509
58.0	3.19622	5.04636	-0.11108	150.0	0.10378	-9.83895	-14.99640
60.0	3.27718	5.15501	-0.00244	152.0	0.14903	-8.26719	-13.42464
62.0	3.27902	5.15745	0.00000	154.0	0.18692	-7.28354	-12.44098
64.0	3.20910	5.06383	-0.09362	156.0	0.18782	-7.26263	-12.42008
66.0	3.07921	4.88439	-0.27306	158.0	0.14280	-8.45262	-13.61006
68.0	2.90339	4.62905	-0.52840	160.0	0.07844	-11.05442	-16.21187
70.0	2.69600	4.30720	-0.85025	162.0	0.05034	-12.98121	-18.13866
72.0	2.47031	3.92752	-1.22993	164.0	0.11282	-9.47618	-14.63363
74.0	2.23762	3.49755	-1.65959	166.0	0.27951	-5.53608	-10.69353
76.0	2.00688	3.02521	-2.13224	168.0	0.50059	-3.00521	-8.16265
78.0	1.78472	2.51569	-2.64175	170.0	0.67771	-1.68955	-6.84699
80.0	1.57564	1.97457	-3.18288	172.0	0.71519	-1.45578	-6.61322
82.0	1.38238	1.40628	-3.75117	174.0	0.57992	-2.36632	-7.52376
84.0	1.20629	0.81453	-4.34291	176.0	0.33113	-4.80004	-9.95748
86.0	1.04773	0.20248	-4.95497	178.0	0.09584	-10.18445	-15.34189
88.0	0.90634	-0.42709	-5.58453	180.0	0.00000	-INFINITY	-INFINITY
90.0	0.76140	1.37128	-6.21872				

TABLE A2-56

EPSLN= 13.7500(NORMALIZED GROUNDPLANE RADIUS)
 MONOPOLE LENGTH= 0.250000(WAVELENGTH)
 MONOPOLE RADIUS= 0.1000E-05(WAVELENGTH)
 NUMBER OF MONOPOLE SEGMENTS= 1
 NUMBER OF DISK SEGMENTS= 41
 NUMBER OF ANNULAR ZONES PER DISK SEGMENT= 1
 RADIATION RESISTANCE DETERMINED BY PATTERN= 0.385409E+02 OHMS

ELEVATION ANGLE (DEG)	DIRECTIVITY (NUMERIC)	DIRECTIVITY (dBi)	RELATIVE POWER (dB)	ELEVATION ANGLE (DEG)	DIRECTIVITY (NUMERIC)	DIRECTIVITY (dBi)	RELATIVE POWER (dB)
0.	0.00000	-INFINITY	-INFINITY	92.0	0.66921	-1.74436	-6.97878
2.0	0.09237	-10.34473	-15.57915	94.0	0.57371	-2.41309	-7.64751
4.0	0.31648	-4.99654	-10.23096	96.0	0.49092	-3.08988	-8.32430
6.0	0.54702	-2.62000	-7.85442	98.0	0.42009	-3.76654	-9.00096
8.0	0.66464	-1.77414	-7.00856	100.0	0.36069	-4.42866	-9.66308
10.0	0.62696	-2.02761	-7.26203	102.0	0.31236	-5.05346	-10.28788
12.0	0.48751	-3.12021	-8.35463	104.0	0.27484	-5.60925	-10.84367
14.0	0.35479	-4.50027	-9.73469	106.0	0.24778	-6.05930	-11.29372
16.0	0.32251	-4.91459	-10.14901	108.0	0.23055	-6.37233	-11.60675
18.0	0.41647	-3.80414	-9.03856	110.0	0.22195	-6.53753	-11.77195
20.0	0.58759	-2.30923	-7.54365	112.0	0.21999	-6.57597	-11.81039
22.0	0.74789	-1.26164	-6.49606	114.0	0.22182	-6.53990	-11.77432
24.0	0.82181	-0.85226	-6.08668	116.0	0.22384	-6.50069	-11.73511
26.0	0.78190	-1.06850	-6.30292	118.0	0.22211	-6.53429	-11.76871
28.0	0.65327	-1.84908	-7.08350	120.0	0.21326	-6.71095	-11.94537
30.0	0.49250	-3.07597	-8.31039	122.0	0.19548	-7.08896	-12.32338
32.0	0.35831	-4.43744	-9.69186	124.0	0.16963	-7.70492	-12.93934
34.0	0.29084	-5.36349	-10.59791	126.0	0.13976	-8.54630	-13.78072
36.0	0.30626	-5.13913	-10.37355	128.0	0.11262	-9.48381	-14.71823
38.0	0.40336	-3.94307	-9.17749	130.0	0.09591	-10.18126	-15.41568
40.0	0.57378	-2.41252	-7.64694	132.0	0.09528	-10.20982	-15.44424
42.0	0.80882	-0.92149	-6.15590	134.0	0.11121	-9.53858	-14.77300
44.0	1.10045	0.41569	-4.81873	136.0	0.13721	-8.62603	-13.86045
46.0	1.43841	1.97881	-3.65561	138.0	0.16108	-7.92970	-13.16412
48.0	1.80687	2.56927	-2.66515	140.0	0.16963	-7.70499	-12.93941
50.0	2.18349	3.39152	-1.84290	142.0	0.15578	-8.07479	-13.30921
52.0	2.54157	4.05102	-1.18340	144.0	0.12429	-9.05569	-14.29011
54.0	2.85429	4.55498	-0.67944	146.0	0.09200	-10.36235	-15.59677
56.0	3.09934	4.91269	-0.32173	148.0	0.08025	-10.93560	-16.19002
58.0	3.26223	5.13514	-0.09928	150.0	0.10169	-9.92732	-15.16174
60.0	3.33766	5.23442	0.00000	152.0	0.14878	-8.27446	-13.50888
62.0	3.32893	5.22304	-0.01138	154.0	0.19330	-7.13767	-12.37209
64.0	3.24596	5.11343	-0.12099	156.0	0.20127	-6.96229	-12.19671
66.0	3.10279	4.91752	-0.31670	158.0	0.15790	-8.01618	-13.25060
68.0	2.91506	4.64647	-0.58794	160.0	0.08698	-10.60600	-15.84042
70.0	2.69808	4.31055	-0.92387	162.0	0.04758	-13.22551	-18.45993
72.0	2.46546	3.91898	-1.31544	164.0	0.10274	-9.88260	-15.11702
74.0	2.22841	3.47995	-1.75446	166.0	0.27430	-5.61774	-10.85216
76.0	1.99354	3.00061	-2.23381	168.0	0.51361	-2.89362	-8.12804
78.0	1.77299	2.48707	-2.74735	170.0	0.71399	-1.46310	-6.69752
80.0	1.56475	1.94445	-3.28997	172.0	0.76639	-1.15550	-6.38992
82.0	1.37507	1.37507	-3.55749	174.0	0.62848	-2.01711	-7.25153
84.0	1.19888	0.75777	-4.44658	176.0	0.36147	-4.41930	-9.65372
86.0	1.04210	0.17545	-5.05437	178.0	0.10505	-9.78594	-15.02036
88.0	0.90235	-0.44627	-5.68669	180.0	0.00000	-INFINITY	-INFINITY
90.0	0.77829	-1.58861	-6.32541				

TABLE A2-57

EPSLN= 14.0000(NORMALIZED GROUNDPLANE RADIUS)
 MONOPOLE LENGTH= 0.250000(WAVELENGTH)
 MONOPOLE RADIUS= 0.1000E-05(WAVELENGTH)
 NUMBER OF MONOPOLE SEGMENTS= 1
 NUMBER OF DISK SEGMENTS= 42
 NUMBER OF ANNULAR ZONES PER DISK SEGMENT= 1
 RADIATION RESISTANCE DETERMINED BY PATTERN= 0.386275E+02 OHMS

ELEVATION ANGLE (DEG)	DIRECTIVITY (NUMERIC)	DIRECTIVITY (dBi)	RELATIVE POWER (dB)	ELEVATION ANGLE (DEG)	DIRECTIVITY (NUMERIC)	DIRECTIVITY (dBi)	RELATIVE POWER (dB)
0.	0.00000	-INFINITY	-INFINITY	92.0	0.66917	-1.74466	-7.02965
2.0	0.09904	-10.04177	-15.32676	94.0	0.57449	-2.40715	-7.69214
4.0	0.33635	-4.73209	-10.01707	96.0	0.49156	-3.08425	-8.36924
6.0	0.57175	-2.42794	-7.71292	98.0	0.41954	-3.77230	-9.05729
8.0	0.67539	-1.70443	-6.98942	100.0	0.35790	-4.46243	-9.74742
10.0	0.60808	-2.16043	-7.44541	102.0	0.30639	-5.13724	-10.42223
12.0	0.43931	-3.57227	-8.85726	104.0	0.26500	-5.76761	-11.05260
14.0	0.29609	-5.28578	-10.57077	106.0	0.23377	-6.31220	-11.59719
16.0	0.28110	-5.51143	-10.79642	108.0	0.21261	-6.72413	-12.00912
18.0	0.41442	-3.82560	-9.11059	110.0	0.20102	-6.96769	-12.25268
20.0	0.63072	-2.00166	-7.28665	112.0	0.19772	-7.03958	-12.32457
22.0	0.82501	-0.83540	-6.12039	114.0	0.20046	-6.97981	-12.26480
24.0	0.91240	-0.39813	-5.68312	116.0	0.20593	-6.86287	-12.14786
26.0	0.86601	-0.62476	-5.90975	118.0	0.21003	-6.77709	-12.06208
28.0	0.71800	-1.43873	-6.72371	120.0	0.20860	-6.80685	-12.09183
30.0	0.53280	-2.73433	-8.01932	122.0	0.19847	-7.02297	-12.30796
32.0	0.37406	-4.27055	-9.55554	124.0	0.17883	-7.47556	-12.76054
34.0	0.28361	-5.47273	-10.75772	126.0	0.15220	-8.17581	-13.46080
36.0	0.27811	-5.55785	-10.84283	128.0	0.12457	-9.04572	-14.33071
38.0	0.35770	-4.46485	-9.74983	130.0	0.10407	-9.82684	-15.11182
40.0	0.51675	-2.86721	-8.15219	132.0	0.09806	-10.08522	-15.37020
42.0	0.74954	-1.25202	-6.53701	134.0	0.10951	-9.60342	-14.89041
44.0	1.04955	0.21003	-5.07495	136.0	0.13417	-8.72333	-14.00832
46.0	1.40535	1.47785	-3.80714	138.0	0.16059	-7.94274	-13.22772
48.0	1.79743	2.54653	-2.73846	140.0	0.17428	-7.58764	-12.87262
50.0	2.19841	3.42108	-1.86390	142.0	0.16518	-7.82049	-13.10547
52.0	2.57674	4.11070	-1.17428	144.0	0.13510	-8.69335	-13.97834
54.0	2.90231	4.62744	-0.65755	146.0	0.09998	-10.00096	-15.28595
56.0	3.15158	4.98529	-0.29970	148.0	0.08332	-10.79262	-16.07760
58.0	3.31081	5.19934	-0.08565	150.0	0.10204	-9.91244	-15.19743
60.0	3.37675	5.28499	0.00000	152.0	0.15208	-8.17923	-13.46422
62.0	3.35530	5.25731	-0.02768	154.0	0.20480	-6.88661	-12.17160
64.0	3.25886	5.13065	-0.15433	156.0	0.22117	-6.55282	-11.83780
66.0	3.10337	4.91834	-0.36645	158.0	0.17962	-7.45648	-12.74146
68.0	2.90569	4.63250	-0.65249	160.0	0.10081	-9.96499	-15.24997
70.0	2.68164	4.28401	-1.00098	162.0	0.04824	-13.16597	-18.45096
72.0	2.44482	3.88247	-1.40251	164.0	0.09558	-10.19639	-15.48137
74.0	2.20611	3.43626	-1.84872	166.0	0.27464	-5.61229	-10.89728
76.0	1.97360	2.95258	-2.33240	168.0	0.53785	-2.69341	-7.97839
78.0	1.75288	2.43752	-2.84746	170.0	0.76761	-1.14857	-6.43356
80.0	1.54744	1.89613	-3.38886	172.0	0.83789	-0.76812	-6.05311
82.0	1.35908	1.32444	-3.95255	174.0	0.69476	-1.58167	-6.86665
84.0	1.18937	0.74952	-4.53546	176.0	0.40244	-3.95300	-9.23799
86.0	1.03502	0.14951	-5.13548	178.0	0.11743	-9.30226	-14.58725
88.0	0.89817	0.46640	-5.75139	180.0	0.00000	-INFINITY	-INFINITY
90.0	0.77565	-1.09776	-6.38275				

TABLE A2-58

EPSLN= 0.7660(NORMALIZED GROUNDPLANE RADIUS)
 MONOPOLE LENGTH= 0.239600(WAVELENGTH)
 MONOPOLE RADIUS= 0.6350E-03(WAVELENGTH)
 NUMBER OF MONOPOLE SEGMENTS= 4
 NUMBER OF DISK SEGMENTS= 12
 RADIATION RESISTANCE DETERMINED BY PATTERN= 0.177438E+02 OHMS

ELEVATION ANGLE (DEG)	DIRECTIVITY (NUMERIC)	DIRECTIVITY (DBI)	RELATIVE POWER (DB)	ELEVATION ANGLE (DEG)	DIRECTIVITY (NUMERIC)	DIRECTIVITY (DBI)	RELATIVE POWER (DB)
0	0.00000	-INFINITY	-INFINITY	92.0	1.50391	1.7721	-0.00683
2.0	0.00181	-27.41896	-29.19799	94.0	1.49781	1.75457	-0.02446
4.0	0.00724	-21.40335	-23.18238	96.0	1.48802	1.72609	-0.05295
6.0	0.01626	-17.88985	-19.66889	98.0	1.47458	1.68670	-0.09234
8.0	0.02882	-15.40275	-17.18178	100.0	1.45758	1.63631	-0.14272
10.0	0.04488	-13.47957	-15.25860	102.0	1.43708	1.57481	-0.20422
12.0	0.06435	-11.91433	-13.69337	104.0	1.41321	1.50206	-0.27697
14.0	0.08715	-10.59717	-12.37621	106.0	1.38608	1.41789	-0.36115
16.0	0.11317	-9.46251	-11.24154	108.0	1.35584	1.32208	-0.45696
18.0	0.14230	-8.46806	-10.24710	110.0	1.32263	1.21440	-0.56464
20.0	0.17438	-7.58497	-9.36400	112.0	1.28664	1.09457	-0.68446
22.0	0.20928	-6.79265	-8.57168	114.0	1.24804	0.96228	-0.81675
24.0	0.24684	-6.07593	-7.85496	116.0	1.20703	0.81717	-0.96186
26.0	0.28686	-5.42328	-7.20232	118.0	1.16381	0.65883	-1.12021
28.0	0.32917	-4.82577	-6.60480	120.0	1.11861	0.48679	-1.29225
30.0	0.37357	-4.27630	-6.05534	122.0	1.07165	0.30053	-1.47850
32.0	0.41984	-3.76920	-5.54823	124.0	1.02317	0.09947	-1.67957
34.0	0.46776	-3.29980	-5.07883	126.0	0.97340	-0.11708	-1.89611
36.0	0.51710	-2.86426	-4.64330	128.0	0.92260	-0.34986	-2.12889
38.0	0.56763	-2.45938	-4.23842	130.0	0.87102	-0.59973	-2.37877
40.0	0.61909	-2.08246	-3.86149	132.0	0.81890	-0.86768	-2.64672
42.0	0.67124	-1.73119	-3.51023	134.0	0.76651	-1.15481	-2.93385
44.0	0.72383	-1.40361	-3.18265	136.0	0.71410	-1.46241	-3.24144
46.0	0.77660	-1.09803	-2.87707	138.0	0.66192	-1.79193	-3.57096
48.0	0.82928	-0.81298	-2.59202	140.0	0.61023	-2.14506	-3.92409
50.0	0.88162	-0.54719	-2.32622	142.0	0.55927	-2.52377	-4.30281
52.0	0.93336	-0.29953	-2.07856	144.0	0.50929	-2.93036	-4.70940
54.0	0.98423	-0.06902	-1.84806	146.0	0.46052	-3.36753	-5.14657
56.0	1.03400	0.14519	-1.63385	148.0	0.41319	-3.83848	-5.61752
58.0	1.08240	0.34386	-1.43517	150.0	0.36753	-4.34705	-6.12609
60.0	1.12919	0.52768	-1.25136	152.0	0.32375	-4.89789	-6.67693
62.0	1.17415	0.69722	-1.08182	154.0	0.28205	-5.49670	-7.27573
64.0	1.21703	0.85302	-0.92601	156.0	0.24263	-6.15054	-7.92958
66.0	1.25764	0.99555	-0.78349	158.0	0.20567	-6.86837	-8.64741
68.0	1.29575	1.12521	-0.65382	160.0	0.17133	-7.66171	-9.44074
70.0	1.33118	1.24237	-0.53666	162.0	0.13977	-8.54573	-10.32476
72.0	1.36375	1.34736	-0.43168	164.0	0.11115	-9.54101	-11.32004
74.0	1.39330	1.44043	-0.33860	166.0	0.08558	-10.67640	-12.45544
76.0	1.41966	1.52185	-0.25718	168.0	0.06318	-11.99420	-13.77324
78.0	1.44272	1.59182	-0.18721	170.0	0.04406	-13.55998	-15.33901
80.0	1.46235	1.65052	-0.12852	172.0	0.02829	-15.48360	-17.26264
82.0	1.47846	1.69808	-0.08095	174.0	0.01595	-17.97105	-19.75009
84.0	1.49095	1.73484	-0.04440	176.0	0.00710	-21.48480	-23.26383
86.0	1.49978	1.76028	-0.01876	178.0	0.00178	-27.50055	-29.27959
88.0	1.50490	1.77506	-0.00397	180.0	0.00000	-INFINITY	-INFINITY
90.0	1.50627	1.77903	0.00000				

TABLE A2-59

EPSLN= 0.9190(NORMALIZED GROUNDPLANE RADIUS)
 MONOPOLE LENGTH= 0.239600(WAVELENGTH)
 MONOPOLE RADIUS= 0.7630E-03(WAVELENGTH)
 NUMBER OF MONOPOLE SEGMENTS= 4
 NUMBER OF DISK SEGMENTS= 11
 RADIATION RESISTANCE DETERMINED BY PATTERN= 0.183449E+02 OHMS

ELEVATION ANGLE (DEG)	DIRECTIVITY (NUMERIC)	DIRECTIVITY (DBI)	RELATIVE POWER (DB)	ELEVATION ANGLE (DEG)	DIRECTIVITY (NUMERIC)	DIRECTIVITY (DBI)	RELATIVE POWER (DB)
0.	0.00000	-INFINITY	-INFINITY	92.0	1.48872	1.72812	-0.00665
2.0	0.00189	-27.24413	-28.97891	94.0	1.48293	1.71121	-0.02357
4.0	0.00753	-21.22930	-22.96407	96.0	1.47366	1.68398	-0.05079
6.0	0.01692	-17.71708	-19.45186	98.0	1.46096	1.64639	-0.08839
8.0	0.02998	-15.23177	-16.96655	100.0	1.44488	1.59832	-0.13646
10.0	0.04666	-13.31088	-15.04566	102.0	1.42549	1.53965	-0.19512
12.0	0.06686	-11.74842	-13.48320	104.0	1.40289	1.47023	-0.26455
14.0	0.09048	-10.43451	-12.16928	106.0	1.37716	1.38985	-0.34492
16.0	0.11739	-9.30356	-11.03833	108.0	1.34844	1.29831	-0.43647
18.0	0.14746	-8.31326	-10.04804	110.0	1.31684	1.19533	-0.53945
20.0	0.18052	-7.43475	-9.16952	112.0	1.28251	1.08061	-0.65416
22.0	0.21640	-6.64741	-8.38219	114.0	1.24561	0.95382	-0.78096
24.0	0.25491	-5.93605	-7.67083	116.0	1.20630	0.81456	-0.92022
26.0	0.29586	-5.28913	-7.02390	118.0	1.16477	0.66239	-1.07239
28.0	0.33903	-4.69766	-6.43244	120.0	1.12120	0.49682	-1.23795
30.0	0.38419	-4.15456	-5.88933	122.0	1.07580	0.31730	-1.41748
32.0	0.43111	-3.65408	-5.38885	124.0	1.02877	0.12319	-1.61159
34.0	0.47956	-3.19154	-4.92632	126.0	0.98035	-0.08620	-1.82098
36.0	0.52929	-2.76309	-4.49786	128.0	0.93075	-0.31168	-2.04645
38.0	0.58003	-2.36547	-4.0924	130.0	0.88021	-0.54413	-2.28890
40.0	0.63155	-1.99594	-3.73072	132.0	0.82898	-0.81457	-2.54935
42.0	0.68357	-1.65218	-3.38696	134.0	0.77729	-1.09415	-2.82893
44.0	0.73584	-1.33219	-3.06897	136.0	0.72541	-1.39419	-3.12896
46.0	0.78809	-1.03423	-2.76900	138.0	0.67357	-1.71617	-3.45095
48.0	0.84008	-0.75679	-2.49157	140.0	0.62204	-2.06184	-3.79662
50.0	0.89154	-0.49858	-2.23335	142.0	0.57106	-2.43320	-4.16797
52.0	0.94223	-0.25842	-1.99320	144.0	0.52089	-2.83256	-4.56734
54.0	0.99190	-0.03531	-1.77009	146.0	0.47177	-3.26268	-4.99745
56.0	1.04031	0.17165	-1.56313	148.0	0.42396	-3.72678	-5.46155
58.0	1.08724	0.36326	-1.37152	150.0	0.37768	-4.22874	-5.96351
60.0	1.13246	0.54022	-1.19455	152.0	0.33318	-4.77324	-6.50801
62.0	1.17576	0.70317	-1.03160	154.0	0.29067	-5.36600	-7.10078
64.0	1.21693	0.85267	-0.88211	156.0	0.25037	-6.01413	-7.74891
66.0	1.25580	0.98920	-0.74557	158.0	0.21249	-6.72660	-8.46138
68.0	1.29218	1.11322	-0.62155	160.0	0.17722	-7.51496	-9.24973
70.0	1.32590	1.22512	-0.50965	162.0	0.14473	-8.39440	-10.12917
72.0	1.35683	1.32524	-0.40953	164.0	0.11520	-9.38552	-11.12030
74.0	1.38481	1.41389	-0.32088	166.0	0.08877	-10.51720	-12.25198
76.0	1.40972	1.49133	-0.24344	168.0	0.06599	-11.83175	-13.56653
78.0	1.43146	1.55780	-0.17698	170.0	0.04576	-13.39475	-15.12953
80.0	1.44993	1.61348	-0.12129	172.0	0.02940	-15.31608	-17.05086
82.0	1.46506	1.65854	-0.07623	174.0	0.01659	-17.80174	-19.53652
84.0	1.47677	1.69312	-0.04166	176.0	0.00739	-21.31420	-23.04897
86.0	1.48501	1.71730	-0.01747	178.0	0.00185	-27.32918	-29.06396
88.0	1.48976	1.73117	-0.00360	180.	0.00000	-INFINITY	-INFINITY
90.0	1.49100	1.73478	0.00000				

TABLE A2-60

EPSLN= 1.0970(NORMALIZED GROUNDPLANE RADIUS)
 MONOPOLE LENGTH= 0.238500(WAVELENGTH)
 MONOPOLE RADIUS= 0.9110E-03(WAVELENGTH)
 NUMBER OF MONOPOLE SEGMENTS= 4
 NUMBER OF DISK SEGMENTS= 13
 RADIATION RESISTANCE DETERMINED BY PATTERN= 0.187752E+02 OHMS

ELEVATION ANGLE (DEG)	DIRECTIVITY (NUMERIC)	DIRECTIVITY (DB1)	RELATIVE POWER (DB)	ELEVATION ANGLE (DEG)	DIRECTIVITY (NUMERIC)	DIRECTIVITY (DB1)	RELATIVE POWER (DB)
0.	0.00000	-INFINITY	-INFINITY	92.0	1.46988	1.66098	-0.00650
2.0	0.00200	-26.98412	-28.65160	94.0	1.46051	1.64504	-0.02245
4.0	0.00800	-20.97041	-22.63790	96.0	1.45198	1.61960	-0.04788
6.0	0.01795	-17.46008	-19.12756	98.0	1.44032	1.58460	-0.08288
8.0	0.03179	-14.97738	-16.64486	100.0	1.42958	1.53992	-0.12756
10.0	0.04943	-13.05983	-14.72732	102.0	1.40780	1.48541	-0.18207
12.0	0.07077	-11.50143	-13.16892	104.0	1.38704	1.42090	-0.24659
14.0	0.09567	-10.19227	-11.89976	106.0	1.36338	1.34615	-0.32133
16.0	0.12397	-9.06675	-10.73424	108.0	1.33688	1.26093	-0.40656
18.0	0.15551	-8.08254	-9.75003	110.0	1.30765	1.16492	-0.50257
20.0	0.19008	-7.21073	-8.87822	112.0	1.27579	1.05779	-0.60969
22.0	0.22747	-6.43071	-8.09819	114.0	1.24141	0.93916	-0.72832
24.0	0.26747	-5.72722	-7.39471	116.0	1.20465	0.80860	-0.85889
26.0	0.30983	-5.08870	-6.75619	118.0	1.16563	0.66561	-1.00188
28.0	0.35431	-4.50613	-6.17362	120.0	1.12452	0.50966	-1.15783
30.0	0.40065	-3.97238	-5.63987	122.0	1.08147	0.34013	-1.32736
32.0	0.44857	-3.48167	-5.14915	124.0	1.03666	0.15635	-1.51114
34.0	0.49782	-3.02927	-4.69676	126.0	0.99028	-0.04244	-1.70992
36.0	0.54812	-2.61127	-4.27876	128.0	0.94252	-0.23708	-1.92457
38.0	0.59919	-2.22439	-3.89187	130.0	0.89361	-0.48853	-2.15602
40.0	0.65075	-1.86583	-3.53331	132.0	0.84375	-0.73786	-2.40535
42.0	0.70255	-1.53321	-3.20069	134.0	0.79318	-1.00628	-2.67376
44.0	0.75431	-1.22447	-2.89196	136.0	0.74214	-1.29514	-2.96263
46.0	0.80578	-0.93785	-2.60533	138.0	0.69087	-1.60601	-3.27349
48.0	0.85669	-0.67176	-2.33925	140.0	0.63964	-1.94067	-3.60815
50.0	0.90680	-0.42486	-2.09235	142.0	0.58869	-2.30117	-3.96865
52.0	0.95589	-0.19593	-1.86341	144.0	0.53828	-2.68989	-4.35738
54.0	1.00372	0.01610	-1.63138	146.0	0.48869	-3.10963	-4.77711
56.0	1.05007	0.21219	-1.43529	148.0	0.44018	-3.56366	-5.23115
58.0	1.09476	0.39318	-1.27430	150.0	0.39301	-4.03591	-5.72340
60.0	1.13759	0.55984	-1.10764	152.0	0.34745	-4.59110	-6.25859
62.0	1.17838	0.71285	-0.95464	154.0	0.30374	-5.17500	-6.84249
64.0	1.21697	0.85281	-0.81468	156.0	0.26213	-5.81476	-7.48225
66.0	1.25322	0.98027	-0.68721	158.0	0.22288	-6.51938	-8.18687
68.0	1.28698	1.09573	-0.57175	160.0	0.18619	-7.30044	-8.96793
70.0	1.31814	1.19963	-0.46786	162.0	0.15229	-8.17318	-9.84067
72.0	1.34659	1.29234	-0.37515	164.0	0.12139	-9.15823	-10.82571
74.0	1.37221	1.37422	-0.29327	166.0	0.09366	-10.28448	-11.95197
76.0	1.39494	1.44557	-0.22192	168.0	0.06927	-11.59428	-13.26177
78.0	1.41470	1.50664	-0.16085	170.0	0.04838	-13.15322	-14.82071
80.0	1.43142	1.55767	-0.10982	172.0	0.03111	-15.07121	-16.73869
82.0	1.44505	1.59884	-0.06865	174.0	0.01756	-17.55425	-19.22173
84.0	1.45556	1.63030	-0.03718	176.0	0.00783	-21.06483	-22.73231
86.0	1.46291	1.65218	-0.01530	178.0	0.00196	-27.07868	-28.74617
88.0	1.46709	1.66456	-0.00293	180.0	0.00000	-INFINITY	-INFINITY
90.0	1.46808	1.66749	0.00000				

TABLE A2-61

EPSLN= 1.3790(NORMALIZED GROUNDPLANE RADIUS)
 MONOPOLE LENGTH= 0.238200(WAVELENGTH)
 MONOPOLE RADIUS= 0.1143E-02(WAVELENGTH)
 NUMBER OF MONOPOLE SEGMENTS= 4
 NUMBER OF DISK SEGMENTS= 20
 RADIATION RESISTANCE DETERMINED BY PATTERN= 0.198933E+02 OHMS

ELEVATION ANGLE (DEG)	DIRECTIVITY (NUMERIC)	DIRECTIVITY (DBI)	RELATIVE POWER (DB)	ELEVATION ANGLE (DEG)	DIRECTIVITY (NUMERIC)	DIRECTIVITY (DBI)	RELATIVE POWER (DB)
0.	0.00000	-INFINITY	-INFINITY	92.0	1.41797	1.51666	-0.00700
2.0	0.00227	-26.44481	-27.96848	94.0	1.41318	1.50196	-0.02170
4.0	0.00905	-20.43334	-21.95701	96.0	1.40389	1.47951	-0.04416
6.0	0.02029	-16.92672	-18.43039	98.0	1.39611	1.44920	-0.07447
8.0	0.03590	-14.44920	-15.97287	100.0	1.38385	1.41090	-0.11277
10.0	0.05574	-12.53828	-14.06195	102.0	1.36912	1.36441	-0.15926
12.0	0.07965	-10.98793	-12.51159	104.0	1.35192	1.30950	-0.21417
14.0	0.10744	-9.68820	-11.21187	106.0	1.33226	1.24588	-0.27778
16.0	0.13888	-8.57347	-10.09714	108.0	1.31016	1.17325	-0.35042
18.0	0.17373	-7.60137	-9.12503	110.0	1.28564	1.09120	-0.43246
20.0	0.21169	-6.74293	-8.26660	112.0	1.25873	0.99933	-0.52433
22.0	0.25249	-5.97748	-7.50115	114.0	1.22946	0.89716	-0.62651
24.0	0.29582	-5.28974	-6.81340	116.0	1.19789	0.78415	-0.73951
26.0	0.34135	-4.66805	-6.19171	118.0	1.16405	0.65972	-0.86395
28.0	0.38875	-4.10334	-5.62701	120.0	1.12803	0.52321	-1.00045
30.0	0.43768	-3.58840	-5.11207	122.0	1.08991	0.37392	-1.14975
32.0	0.48782	-3.11738	-4.64104	124.0	1.04979	0.21103	-1.31263
34.0	0.53883	-2.68547	-4.20913	126.0	1.00779	0.03369	-1.48997
36.0	0.59038	-2.28867	-3.81234	128.0	0.96404	-0.15907	-1.68273
38.0	0.64215	-1.92360	-3.44727	130.0	0.91869	-0.36831	-1.89198
40.0	0.69384	-1.58739	-3.11106	132.0	0.87192	-0.59523	-2.11890
42.0	0.74515	-1.27755	-2.80121	134.0	0.82392	-0.84114	-2.36481
44.0	0.79581	-0.99192	-2.51559	136.0	0.77490	-1.10753	-2.63120
46.0	0.84555	-0.72862	-2.25229	138.0	0.72509	-1.39606	-2.91972
48.0	0.89413	-0.48599	-2.00966	140.0	0.67474	-1.70862	-3.23229
50.0	0.94134	-0.26255	-1.78622	142.0	0.62411	-2.04737	-3.57104
52.0	0.98697	-0.05698	-1.58065	144.0	0.57348	-2.41480	-3.93847
54.0	1.03084	0.13191	-1.39176	146.0	0.52314	-2.81380	-4.33747
56.0	1.07280	0.30517	-1.21849	148.0	0.47340	-3.24774	-4.77141
58.0	1.11270	0.46379	-1.05988	150.0	0.42456	-3.72064	-5.24430
60.0	1.15043	0.60862	-0.91505	152.0	0.37694	-4.23730	-5.76097
62.0	1.18590	0.74046	-0.78320	154.0	0.33086	-4.80358	-6.32725
64.0	1.21900	0.86005	-0.66362	156.0	0.28663	-5.42671	-6.95038
66.0	1.24969	0.96802	-0.55565	158.0	0.24458	-6.11576	-7.63942
68.0	1.27790	1.06498	-0.45868	160.0	0.20300	-6.88237	-8.40604
70.0	1.30361	1.15148	-0.37219	162.0	0.16820	-7.74185	-9.26552
72.0	1.32678	1.22798	-0.29569	164.0	0.13444	-8.71487	-10.23854
74.0	1.34739	1.29493	-0.22873	166.0	0.10398	-9.83041	-11.35407
76.0	1.36544	1.35273	-0.17094	168.0	0.07708	-11.13081	-12.54448
78.0	1.38092	1.40170	-0.12197	170.0	0.05393	-12.68175	-14.20541
80.0	1.39384	1.44214	-0.08153	172.0	0.03473	-14.59313	-16.11680
82.0	1.40421	1.47431	-0.04936	174.0	0.01963	-17.07101	-18.59468
84.0	1.41202	1.49840	-0.02526	176.0	0.00875	-20.57789	-22.10156
86.0	1.41729	1.51459	-0.00908	178.0	0.00219	-26.58952	-28.11319
88.0	1.42003	1.52299	-0.00068	180.0	0.00000	-INFINITY	-INFINITY
90.0	1.42026	1.52367	0.00000				

TABLE A2-62

EPSLN= 1.5930(NORMALIZED GROUNDPLANE RADIUS)
 MONOPOLE LENGTH= 0.237900(WAVELENGTH)
 MONOPOLE RADIUS= 0.1321E-02(WAVELENGTH)
 NUMBER OF MONOPOLE SEGMENTS= 4
 NUMBER OF DISK SEGMENTS= 26
 RADIATION RESISTANCE DETERMINED BY PATTERN= 0.209239E+02 OHMS

ELEVATION ANGLE (DEG)	DIRECTIVITY (NUMERIC)	DIRECTIVITY (DBI)	RELATIVE POWER (DB)	ELEVATION ANGLE (DEG)	DIRECTIVITY (NUMERIC)	DIRECTIVITY (DBI)	RELATIVE POWER (DB)
0.	0.00000	-INFINITY	-INFINITY	92.0	1.36949	1.36559	-0.01131
2.0	0.00256	-25.91172	-27.28861	94.0	1.36493	1.35109	-0.02580
4.0	0.01023	-19.90232	-21.77922	96.0	1.35852	1.33064	-0.04625
6.0	0.02291	-16.39915	-17.77605	98.0	1.35024	1.30412	-0.07277
8.0	0.04049	-13.92645	-15.30334	100.0	1.34009	1.27134	-0.10555
10.0	0.06278	-12.02170	-13.39859	102.0	1.32803	1.23208	-0.14481
12.0	0.08956	-10.47884	-11.85573	104.0	1.31403	1.18504	-0.19085
14.0	0.12056	-9.18792	-10.56481	106.0	1.29804	1.13289	-0.24401
16.0	0.15948	-8.08326	-9.46016	108.0	1.28003	1.07220	-0.30469
18.0	0.19398	-7.12248	-8.49937	110.0	1.25995	1.00353	-0.37336
20.0	0.23569	-6.27657	-7.65346	112.0	1.23776	0.92835	-0.45034
22.0	0.28023	-5.52482	-6.90171	114.0	1.21341	0.84008	-0.53681
24.0	0.32720	-4.85188	-6.22877	116.0	1.18689	0.74409	-0.63280
26.0	0.37618	-4.24606	-5.62296	118.0	1.15816	0.63768	-0.73921
28.0	0.42675	-3.69825	-5.07514	120.0	1.12722	0.52008	-0.85681
30.0	0.47850	-3.20115	-4.57804	122.0	1.09407	0.39045	-0.98644
32.0	0.53102	-2.74886	-4.12575	124.0	1.05874	0.24788	-1.12901
34.0	0.58391	-2.33651	-3.71340	126.0	1.02126	0.09138	-1.28551
36.0	0.63679	-1.96001	-3.33690	128.0	0.98172	-0.08014	-1.45703
38.0	0.68930	-1.61592	-2.99282	130.0	0.94019	-0.26785	-1.64474
40.0	0.74109	-1.30128	-2.67817	132.0	0.89679	-0.47307	-1.84996
42.0	0.79186	-1.01351	-2.39041	134.0	0.85168	-0.69723	-2.07412
44.0	0.84132	-0.75038	-2.12728	136.0	0.80502	-0.94193	-2.31882
46.0	0.88922	-0.50991	-1.88680	138.0	0.75702	-1.20893	-2.58582
48.0	0.93533	-0.29033	-1.66722	140.0	0.70791	-1.50024	-2.87713
50.0	0.97948	-0.09006	-1.46696	142.0	0.65794	-1.81812	-3.19501
52.0	1.02148	0.09231	-1.28458	144.0	0.60742	-2.16514	-3.54203
54.0	1.06123	0.25808	-1.11881	146.0	0.55663	-2.54430	-3.92119
56.0	1.09861	0.40843	-0.96846	148.0	0.50593	-2.95906	-4.33595
58.0	1.13356	0.54443	-0.83246	150.0	0.45567	-3.41351	-4.79040
60.0	1.16602	0.66707	-0.70982	152.0	0.40621	-3.91255	-5.28944
62.0	1.19599	0.77727	-0.59963	154.0	0.35792	-4.46209	-5.83898
64.0	1.22345	0.87585	-0.50104	156.0	0.31121	-5.06944	-6.44633
66.0	1.24842	0.96360	-0.41330	158.0	0.26646	-5.74373	-7.12062
68.0	1.27093	1.04122	-0.33568	160.0	0.22404	-6.49668	-7.87357
70.0	1.29103	1.10936	-0.26753	162.0	0.18435	-7.34362	-8.72032
72.0	1.30877	1.16863	-0.20826	164.0	0.14773	-8.30531	-9.68220
74.0	1.32421	1.21956	-0.15733	166.0	0.11453	-9.41073	-10.78762
76.0	1.33741	1.26264	-0.11425	168.0	0.08507	-10.70229	-12.07918
78.0	1.34844	1.29831	-0.07858	170.0	0.05963	-12.24568	-13.62257
80.0	1.35736	1.32695	-0.04994	172.0	0.03845	-14.15086	-15.52775
82.0	1.36423	1.34888	-0.02801	174.0	0.02176	-16.62389	-18.00078
84.0	1.36911	1.36437	-0.01252	176.0	0.00971	-20.12729	-21.50418
86.0	1.37204	1.37366	-0.00323	178.0	0.00243	-26.13682	-27.51371
88.0	1.37306	1.37689	0.00000	180.0	0.00000	-INFINITY	-INFINITY
90.0	1.37220	1.37418	-0.00271				

TABLE A2-63

EPSLN= 1.9150(NORMALIZED GROUNDPLANE RADIUS)
 MONOPOLE LENGTH= 0.237400(WAVELENGTH)
 MONOPOLE RADIUS= 0.1589E-02(WAVELENGTH)
 NUMBER OF MONOPOLE SEGMENTS= 4
 NUMBER OF DISK SEGMENTS= 27
 RADIATION RESISTANCE DETERMINED BY PATTERN= 0.229245E+02 OHMS

ELEVATION ANGLE (DEG)	DIRECTIVITY (NUMERIC)	DIRECTIVITY (DBI)	RELATIVE POWER (DB)	ELEVATION ANGLE (DEG)	DIRECTIVITY (NUMERIC)	DIRECTIVITY (DBI)	RELATIVE POWER (DB)
0	0.0000	-INFINITY	-INFINITY	92.0	1.27250	1.04659	-0.05527
2.0	0.00324	-24.88942	-25.99127	94.0	1.26738	1.02906	-0.07279
4.0	0.01293	-18.88366	-19.98551	96.0	1.26164	1.00935	-0.09251
6.0	0.02893	-15.38654	-16.48840	98.0	1.25525	0.98729	-0.11456
8.0	0.05102	-12.92230	-14.02415	100.0	1.24815	0.96268	-0.13917
10.0	0.07892	-11.02838	-12.13023	102.0	1.24028	0.93519	-0.16667
12.0	0.11224	-9.49871	-10.60056	104.0	1.23152	0.90440	-0.19745
14.0	0.15055	-8.22329	-9.32514	106.0	1.22175	0.86984	-0.23201
16.0	0.19336	-7.13642	-8.23828	108.0	1.21085	0.83092	-0.27094
18.0	0.24012	-6.19565	-7.29750	110.0	1.19867	0.78698	-0.31487
20.0	0.29027	-5.37193	-6.47379	112.0	1.18503	0.73730	-0.36456
22.0	0.34320	-4.64450	-5.74635	114.0	1.16978	0.68105	-0.42080
24.0	0.39830	-3.99793	-5.09979	116.0	1.15275	0.61737	-0.48449
26.0	0.45494	-3.42048	-4.52233	118.0	1.13378	0.54529	-0.55657
28.0	0.51252	-2.90293	-4.00478	120.0	1.11270	0.46379	-0.63807
30.0	0.57044	-2.43792	-3.53978	122.0	1.08937	0.37177	-0.73009
32.0	0.62814	-2.01946	-3.12132	124.0	1.06367	0.26806	-0.83379
34.0	0.68508	-1.64237	-2.74443	126.0	1.03548	0.15141	-0.95044
36.0	0.74079	-1.30308	-2.40493	128.0	1.00473	0.02049	-1.08137
38.0	0.79480	-0.99741	-2.09926	130.0	0.97137	-0.12615	-1.22800
40.0	0.84674	-0.72248	-1.82434	132.0	0.93540	-0.29004	-1.39189
42.0	0.89627	-0.47561	-1.57746	134.0	0.89684	-0.47285	-1.57471
44.0	0.94310	-0.25441	-1.35626	136.0	0.85577	-0.67641	-1.77826
46.0	0.98702	-0.05675	-1.15860	138.0	0.81233	-0.90268	-2.00453
48.0	1.02784	0.11928	-0.98258	140.0	0.76668	-1.15388	-2.25573
50.0	1.06547	0.27542	-0.82644	142.0	0.71904	-1.43245	-2.53430
52.0	1.09983	0.41326	-0.68859	144.0	0.66971	-1.74116	-2.84301
54.0	1.13092	0.53430	-0.56755	146.0	0.61899	-2.08315	-3.18500
56.0	1.15875	0.63989	-0.46196	148.0	0.56728	-2.46205	-3.56390
58.0	1.18340	0.73132	-0.37053	150.0	0.51498	-2.88211	-3.98396
60.0	1.20498	0.80979	-0.29206	152.0	0.46256	-3.34834	-4.45020
62.0	1.22361	0.87644	-0.22541	154.0	0.41051	-3.86681	-4.96867
64.0	1.23946	0.93233	-0.16952	156.0	0.35934	-4.44934	-5.54678
66.0	1.25270	0.97848	-0.12338	158.0	0.30960	-5.09194	-6.19379
68.0	1.26352	1.01583	-0.08602	160.0	0.26184	-5.81965	-6.92150
70.0	1.27213	1.04530	-0.05655	162.0	0.21660	-6.64350	-7.74535
72.0	1.27871	1.06772	-0.03413	164.0	0.17441	-7.58430	-8.68616
74.0	1.28348	1.08389	-0.01796	166.0	0.13580	-8.67113	-9.77298
76.0	1.28663	1.09453	-0.00732	168.0	0.10124	-9.94646	-11.04831
78.0	1.28834	1.10032	-0.00154	170.0	0.07119	-11.47787	-12.57787
80.0	1.28880	1.10185	0.00000	172.0	0.04603	-13.36982	-14.47167
82.0	1.28815	1.09968	-0.00218	174.0	0.02610	-15.83396	-16.93581
84.0	1.28655	1.09425	-0.00760	176.0	0.01167	-19.33099	-20.43284
86.0	1.28409	1.08597	-0.01589	178.0	0.00293	-25.33659	-26.43855
88.0	1.28089	1.07513	-0.02673	180.0	0.00000	-INFINITY	-INFINITY
90.0	1.27701	1.06196	-0.03990				

TABLE A2-64

EPSLN= 2.1970(NORMALIZED GROUNDPLANE RADIUS)
 MONOPOLE LENGTH= 0.236600(WAVELENGTH)
 MONOPOLE RADIUS= 0.1822E-02(WAVELENGTH)
 NUMBER OF MONOPOLE SEGMENTS= 4
 NUMBER OF DISK SEGMENTS= 27
 RADIATION RESISTANCE DETERMINED BY PATTERN= 0.253505E+02 OHMS

ELEVATION ANGLE (DEG)	DIRECTIVITY (NUMERIC)	DIRECTIVITY (DBI)	RELATIVE POWER (DB)	ELEVATION ANGLE (DEG)	DIRECTIVITY (NUMERIC)	DIRECTIVITY (DBI)	RELATIVE POWER (DB)
0.	0.00000	-INFINITY	-INFINITY	92.0	1.15871	0.63976	-0.39583
2.0	0.00420	-23.76991	-24.80549	94.0	0.61221	0.61221	-0.42337
4.0	0.01672	-17.76771	-18.80329	96.0	0.58725	0.58725	-0.44833
6.0	0.03735	-14.27651	-15.31210	98.0	0.56479	0.56479	-0.47079
8.0	0.06576	-11.82054	-12.85612	100.0	0.54458	0.54458	-0.49101
10.0	0.10146	-9.93723	-10.97281	102.0	0.52623	0.52623	-0.50935
12.0	0.14386	-8.42048	-9.45607	104.0	0.50921	0.50921	-0.52637
14.0	0.19230	-7.16029	-8.19587	106.0	0.49284	0.49284	-0.54274
16.0	0.24599	-6.09089	-7.12648	108.0	0.47632	0.47632	-0.55926
18.0	0.30410	-5.16983	-6.20541	110.0	0.45871	0.45871	-0.57688
20.0	0.36576	-4.36801	-5.40359	112.0	0.43897	0.43897	-0.59662
22.0	0.43007	-3.66462	-4.70020	114.0	0.41595	0.41595	-0.61963
24.0	0.49611	-3.04420	-4.07978	116.0	0.38843	0.38843	-0.64715
26.0	0.56300	-2.49495	-3.53053	118.0	0.35509	0.35509	-0.68049
28.0	0.62983	-2.00760	-3.04318	120.0	0.31453	0.31453	-0.72105
30.0	0.69587	-1.57474	-2.61032	122.0	0.26529	0.26529	-0.77030
32.0	0.76027	-1.19030	-2.22588	124.0	0.20584	0.20584	-0.82975
34.0	0.82238	-0.84925	-1.88483	126.0	0.13457	0.13457	-0.90101
36.0	0.88159	-0.54734	-1.58292	128.0	0.04982	0.04982	-0.98576
38.0	0.93736	-0.28092	-1.31650	130.0	0.98851	-0.05017	-1.08575
40.0	0.98928	-0.04683	-1.08241	132.0	0.96222	-0.16724	-1.20282
42.0	1.03698	0.15771	-0.87787	134.0	0.93254	-0.30334	-1.33892
44.0	1.08023	0.33518	-0.70041	136.0	0.89938	-0.46055	-1.48614
46.0	1.11887	0.48779	-0.54779	138.0	0.86276	-0.64111	-1.67669
48.0	1.15281	0.61759	-0.41799	140.0	0.82273	-0.84743	-1.88302
50.0	1.18207	0.72644	-0.30915	142.0	0.77944	-1.08219	-2.11777
52.0	1.20672	0.81606	-0.21952	144.0	0.73311	-1.34832	-2.38391
54.0	1.22690	0.88809	-0.14750	146.0	0.68404	-1.64916	-2.68475
56.0	1.24281	0.94405	-0.09154	148.0	0.63263	-1.98850	-3.02409
58.0	1.25470	0.98540	-0.05018	150.0	0.57933	-2.37073	-3.40631
60.0	1.26286	1.01355	-0.02203	152.0	0.52469	-2.80101	-3.83659
62.0	1.26761	1.02984	-0.00574	154.0	0.46930	-3.28550	-4.32109
64.0	1.26928	1.03558	0.00000	156.0	0.41383	-3.83175	-4.86733
66.0	1.26825	1.03204	-0.00355	158.0	0.35900	-4.44909	-5.48467
68.0	1.26486	1.02044	-0.01515	160.0	0.30553	-5.14942	-6.18500
70.0	1.25950	1.00198	-0.03361	162.0	0.25420	-5.94826	-6.98385
72.0	1.25251	0.97782	-0.05776	164.0	0.20575	-6.86650	-7.90209
74.0	1.24425	0.94909	-0.08650	166.0	0.16094	-7.93328	-8.96886
76.0	1.23505	0.91685	-0.11873	168.0	0.12047	-9.19112	-10.22670
78.0	1.22522	0.88213	-0.15345	170.0	0.08500	-10.70581	-11.74139
80.0	1.21504	0.84590	-0.18969	172.0	0.05511	-12.58738	-13.62296
82.0	1.20477	0.80903	-0.22655	174.0	0.03132	-15.04198	-16.07756
84.0	1.19463	0.77233	-0.26325	176.0	0.01402	-18.53218	-19.56776
86.0	1.18482	0.73652	-0.29906	178.0	0.00352	-24.53377	-25.56935
88.0	1.17549	0.70219	-0.33339	180.0	0.00000	-INFINITY	-INFINITY
90.0	1.16676	0.66982	-0.36576				

TABLE A2-65

EPSLN= 3 0000(NORMALIZED GROUNDPLANE RADIUS)
 MONOPOLE LENGTH= 0 23500(WAVELENGTH)
 MONOPOLE RADIUS= 0 2478E-02(WAVELENGTH)
 NUMBER OF MONOPOLE SEGMENTS= 4
 NUMBER OF DISK SEGMENTS= 27
 RADIATION RESISTANCE DETERMINED BY PATTERN= 0 39342/E+02 OHMS

ELEVATION ANGLE (DEG)	DIRECTIVITY (NUMERIC)	DIRECTIVITY (DBI)	RELATIVE POWER (DB)	ELEVATION ANGLE (DEG)	DIRECTIVITY (NUMERIC)	DIRECTIVITY (DBI)	RELATIVE POWER (DB)
0	0 00000	-INFINITY	-INFINITY	92 0	0 73392	-1 34351	-3 88652
2 0	0 00987	-20 05844	-22 60144	94 0	0 70441	-1 52173	-4 06474
4 0	0 03921	-14 06658	-16 60958	96 0	0 67950	-1 67809	-4 22109
6 0	0 08725	-10 59258	-13 10359	98 0	0 65928	-1 80932	-4 35233
8 0	0 15273	-8 16063	-10 70364	100 0	0 64378	-1 91265	-4 45566
10 0	0 23399	-6 30811	-8 85111	102 0	0 63300	-1 98594	-4 52895
12 0	0 32894	-4 82882	-7 37183	104 0	0 62691	-2 02796	-4 57096
14 0	0 43524	-3 61267	-6 15568	106 0	0 62540	-2 03845	-4 58146
16 0	0 55032	-2 59381	-5 13682	108 0	0 62831	-2 01826	-4 56127
18 0	0 67148	-1 72965	-4 27265	110 0	0 63544	-1 96528	-4 51229
20 0	0 79598	-0 99096	-3 53397	112 0	0 64649	-1 89436	-4 43737
22 0	0 92113	-0 35679	-2 89980	114 0	0 66113	-1 79715	-4 34016
24 0	1 04435	0 18845	-2 35436	116 0	0 67891	-1 68188	-4 22489
26 0	1 16325	0 65673	-1 88627	118 0	0 69933	-1 55316	-4 09617
28 0	1 27570	1 03747	-1 48554	120 0	0 72181	-1 41578	-3 95879
30 0	1 37982	1 39823	-1 14477	122 0	0 74567	-1 27455	-3 81756
32 0	1 47409	1 68524	-0 85777	124 0	0 77017	-1 13416	-3 67717
34 0	1 55728	1 92367	-0 61934	126 0	0 79449	-0 99912	-3 54213
36 0	1 62851	2 11791	-0 42510	128 0	0 81777	-0 87371	-3 41672
38 0	1 68723	2 27175	-0 27126	130 0	0 83908	-0 76198	-3 30499
40 0	1 73318	2 38845	-0 15456	132 0	0 85748	-0 66775	-3 21076
42 0	1 76640	2 47090	-0 07211	134 0	0 87203	-0 59467	-3 13768
44 0	1 78717	2 52165	0 00136	136 0	0 88181	-0 54625	-3 08926
46 0	1 79598	2 54301	0 00000	138 0	0 88595	-0 52592	-3 04893
48 0	1 79351	2 53703	-0 00597	140 0	0 88367	-0 53710	-3 08011
50 0	1 78058	2 50562	-0 03739	142 0	0 87432	-0 58328	-3 12629
52 0	1 75812	2 45049	-0 09251	144 0	0 85741	-0 66811	-3 21112
54 0	1 72714	2 37327	-0 16974	146 0	0 83263	-0 79548	-3 33849
56 0	1 68867	2 27545	-0 26756	148 0	0 79990	-0 96565	-3 51265
58 0	1 64378	2 15845	-0 38456	150 0	0 75938	-1 19540	-3 73840
60 0	1 59354	2 02362	-0 51939	152 0	0 71151	-1 47822	-4 02122
62 0	1 53896	1 87228	-0 67073	154 0	0 65697	-1 82455	-4 36756
64 0	1 48105	1 70571	-0 83730	156 0	0 59674	-2 24216	-4 78517
66 0	1 42076	1 52520	-1 01781	158 0	0 53204	-2 74058	-5 28359
68 0	1 35895	1 33205	-1 21096	160 0	0 46431	-3 33188	-5 87488
70 0	1 29647	1 12761	-1 41539	162 0	0 39521	-4 03171	-6 57471
72 0	1 23405	0 91332	-1 62969	164 0	0 32651	-4 86107	-7 40408
74 0	1 17238	0 69069	-1 85232	166 0	0 26006	-5 84921	-8 39222
76 0	1 11209	0 46139	-2 08162	168 0	0 19775	-7 03874	-9 58175
78 0	1 05372	0 23726	-2 31575	170 0	0 14140	-8 49551	-11 03852
80 0	0 99778	-0 00965	-2 55266	172 0	0 09269	-10 32453	-12 87263
82 0	0 94470	-0 24707	-2 79008	174 0	0 05312	-12 74726	-15 29027
84 0	0 89486	-0 48246	-3 02547	176 0	0 02393	-16 21103	-18 75404
86 0	0 84859	-0 71300	-3 25601	178 0	0 00603	-22 19676	-24 73977
88 0	0 80619	-0 93561	-3 47861	180	0 00000	-INFINITY	-INFINITY
90 0	0 76790	-1 14695	-3 68995				

TABLE A2-66

EPSLN= 4 0000(NORMALIZED GROUNDPLANE RADIUS)
 MONOPOLE LENGTH= 0 234600(WAVELENGTH)
 MONOPOLE RADIUS= 0 3304E-02(WAVELENGTH)
 NUMBER OF MONOPOLE SEGMENTS= 4
 NUMBER OF DISK SEGMENTS= 2/
 RADIATION RESISTANCE DETERMINED BY PATTERN= 0 405539E+02 OHMS

ELEVATION ANGLE (DEG)	DIRECTIVITY (NUMERIC)	DIRECTIVITY (DBI)	RELATIVE POWER (DB)	ELEVATION ANGLE (DEG)	DIRECTIVITY (NUMERIC)	DIRECTIVITY (DBI)	RELATIVE POWER (DB)
0	0 00000	-INFINITY	-INFINITY	92 0	0 62892	-2 01408	-5 92481
2 0	0 01927	-17 15085	-21 06158	94 0	0 57077	-2 43538	-6 34611
4 0	0 07634	-11 17250	-15 08323	96 0	0 51534	-2 87905	-6 78978
6 0	0 16901	-7 72092	-11 63165	98 0	0 46275	-3 34651	-7 25724
8 0	0 29376	-5 32011	-9 23085	100 0	0 41318	-3 83864	-7 74937
10 0	0 44594	-3 50724	-7 41798	102 0	0 36683	-4 35533	-8 26606
12 0	0 62004	-2 07583	-5 98656	104 0	0 32399	-4 89471	-8 80544
14 0	0 80995	-0 91541	-4 82614	106 0	0 28497	-5 45205	-9 36279
16 0	1 00932	0 04028	-3 87046	108 0	0 25014	-6 01815	-9 92889
18 0	1 21180	0 83432	-3 07642	110 0	0 21992	-6 57726	-10 48799
20 0	1 41139	1 49646	-2 41428	112 0	0 19477	-7 10484	-11 01537
22 0	1 60260	2 04826	-1 86247	114 0	0 17514	-7 56626	-11 47700
24 0	1 78073	2 50598	-1 40475	116 0	0 16149	-7 91847	-11 82920
26 0	1 94191	2 88228	-1 02845	118 0	0 15428	-8 11702	-12 02775
28 0	2 08320	3 18731	-0 72342	120 0	0 15386	-8 12870	-12 03944
30 0	2 20264	3 42943	-0 48130	122 0	0 16053	-7 94440	-11 85513
32 0	2 29914	3 61566	-0 29507	124 0	0 17443	-7 58369	-11 49442
34 0	2 37246	3 75200	-0 15874	126 0	0 19554	-7 08758	-10 99831
36 0	2 42306	3 84365	-0 06708	128 0	0 22362	-6 50496	-10 41569
38 0	2 45200	3 89521	-0 01553	130 0	0 25816	-5 88107	-9 79180
40 0	2 46078	3 91073	0 00000	132 0	0 29841	-5 25192	-9 16266
42 0	2 45124	3 89386	-0 01688	134 0	0 34327	-4 64358	-8 55432
44 0	2 42539	3 84782	-0 06291	136 0	0 39139	-4 07391	-7 98464
46 0	2 38537	3 77555	-0 13519	138 0	0 44108	-3 55479	-7 46553
48 0	2 3327	3 67965	-0 23109	140 0	0 49044	-3 09418	-7 00491
50 0	2 27114	3 56244	-0 34829	142 0	0 53733	-2 69758	-6 60832
52 0	2 20090	3 42600	-0 48473	144 0	0 57954	-2 36917	-6 27991
54 0	2 12430	3 27215	-0 63858	146 0	0 61482	-2 11249	-6 02322
56 0	2 04290	3 10247	-0 80826	148 0	0 64107	-1 93098	-5 84171
58 0	1 95809	2 91832	-0 99241	150 0	0 65639	-1 82839	-5 73912
60 0	1 87105	2 72086	-1 18987	152 0	0 65931	-1 80911	-5 71985
62 0	1 78280	2 51104	-1 39970	154 0	0 64885	-1 87852	-5 78926
64 0	1 69419	2 28961	-1 62112	156 0	0 62459	-2 04336	-5 95409
66 0	1 60589	2 05716	-1 85357	158 0	0 58719	-2 31223	-6 22297
68 0	1 51848	1 81409	-2 09664	160 0	0 53748	-2 69638	-6 60712
70 0	1 43240	1 56064	-2 35010	162 0	0 47745	-3 21075	-7 12148
72 0	1 34799	1 29686	-2 61387	164 0	0 40967	-3 87570	-7 78644
74 0	1 26552	1 02267	-2 88906	166 0	0 33729	-4 71993	-8 63067
76 0	1 18517	0 73781	-3 17292	168 0	0 26390	-5 78560	-9 69633
78 0	1 10709	0 44185	-3 46889	170 0	0 19328	-7 13817	-11 04890
80 0	1 03138	0 13417	-3 77656	172 0	0 12920	-8 88743	-12 79817
82 0	0 95808	-0 18599	-4 09673	174 0	0 07517	-11 23933	-15 15006
84 0	0 88724	-0 51960	-4 43034	176 0	0 03423	-14 65627	-18 56700
86 0	0 81888	-0 86781	-4 77855	178 0	0 00868	-20 61395	-24 52469
88 0	0 75302	-1 23195	-5 14268	180	0 00000	-INFINITY	-INFINITY
90 0	0 68968	-1 61349	-5 52423				

APPENDIX A3. OBLATE SPHEROIDAL WAVE FUNCTIONS

	<u>Page</u>
Table A3-1 - A3-4; $ka = 3, 4, 5, \sqrt{42}$, $h/\lambda = 0.25$	122

TABLE A3-1. DIRECTIVITY AND RADIATION RESISTANCE OF QUARTERWAVE MONOPOLE MOUNTED ON CIRCULAR GROUNDPLANE OF FINITE EXTENT, $2\pi a/\lambda = 3.0$

ELEVATION ANGLE, θ (DEG)	$2\pi a/\lambda = 3.00$		radiation resistance = 37.4765 ohms		RELATIVE POWER (dB)
	DIRECTIVITY $d(\theta)$ (NUMERIC)	DIRECTIVITY $D(\theta)$ (dB)	ELEVATION ANGLE, θ (DEG)	DIRECTIVITY $d(\theta)$ (NUMERIC)	
0.0000	0.00000	-INFINITY	92.00000	0.76429	-1.16744
2.0000	0.00000	-20.03252	94.00000	0.73249	-1.35197
4.0000	0.00993	-14.04121	96.00000	0.70472	-1.51980
6.0000	0.03943	-10.56811	98.00000	0.68111	-1.66780
8.0000	0.08774	-8.13740	100.00000	0.66176	-1.79299
10.0000	0.15355	-6.28645	102.00000	0.64674	-1.89273
12.0000	0.23516	-4.80905	104.00000	0.63607	-1.96494
14.0000	0.33044	-3.59507	106.00000	0.62976	-2.00827
16.0000	0.43701	-2.57866	108.00000	0.62774	-2.02223
18.0000	0.55225	-1.71716	110.00000	0.62989	-2.00735
20.0000	0.67342	-0.98135	112.00000	0.63604	-1.96315
22.0000	0.79775	-0.35021	114.00000	0.64593	-1.89811
24.0000	0.92353	0.19189	116.00000	0.65924	-1.80957
26.0000	1.04517	0.65696	118.00000	0.67554	-1.70350
28.0000	1.16331	1.05449	120.00000	0.69433	-1.58436
30.0000	1.27482	1.39209	122.00000	0.71501	-1.45689
32.0000	1.37787	1.67604	124.00000	0.73690	-1.32593
34.0000	1.47098	1.91164	126.00000	0.75922	-1.19331
36.0000	1.55297	2.10331	128.00000	0.78114	-1.07272
38.0000	1.62305	2.25492	130.00000	0.80174	-0.95966
40.0000	1.68071	2.36983	132.00000	0.82007	-0.86147
42.0000	1.72577	2.45100	134.00000	0.83517	-0.78226
44.0000	1.75833	2.50110	136.00000	0.84606	-0.72598
46.0000	1.77873	2.52250	138.00000	0.85183	-0.69448
48.0000	1.78541	2.51738	140.00000	0.85162	-0.69755
50.0000	1.77325	2.48769	142.00000	0.84470	-0.73298
52.0000	1.75198	2.43528	144.00000	0.83048	-0.80670
54.0000	1.72259	2.36182	146.00000	0.80857	-0.92282
56.0000	1.68512	2.26889	148.00000	0.77879	-1.08380
58.0000	1.64360	2.15797	150.00000	0.74121	-1.30059
60.0000	1.59604	2.03045	152.00000	0.69618	-1.57279
62.0000	1.54442	1.88766	154.00000	0.64432	-1.90897
64.0000	1.48967	1.73089	156.00000	0.58655	-2.31596
66.0000	1.43264	1.56138	158.00000	0.52404	-2.80637
68.0000	1.37416	1.38037	160.00000	0.45821	-3.38933
70.0000	1.31494	1.18908	162.00000	0.39070	-4.08152
72.0000	1.25567	0.98876	164.00000	0.32330	-4.90400
74.0000	1.19694	0.78071	166.00000	0.25787	-5.88601
76.0000	1.13928	0.56630	168.00000	0.19633	-7.07020
78.0000	1.08318	0.34700	170.00000	0.14053	-8.52244
80.0000	1.02906	0.12440	172.00000	0.09220	-10.35283
82.0000	0.97729	-0.09975	174.00000	0.05287	-12.76756
84.0000	0.92822	-0.32348	176.00000	0.02383	-16.22925
86.0000	0.88214	-0.54464	178.00000	0.00601	-22.21373
88.0000	0.83930	-0.76082	180.00000	0.00000	-INFINITY
90.0000	0.79995	-0.96938			

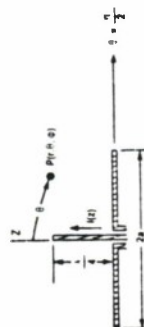


TABLE A3-2. DIRECTIVITY AND RADIATION RESISTANCE OF QUARTERWAVE MONOPOLE MOUNTED ON CIRCULAR
GROUNDPLANE OF FINITE EXTENT, $2\pi a/\lambda = 4.0$

ELEVATION ANGLE, °	$2\pi a/\lambda = 4.00$		RELATIVE POWER (dB)	radiation resistance = 42.6724 ohms		RELATIVE POWER (dB)
	DIRECTIVITY $d(\cdot)$ (NUMERIC)	DIRECTIVITY $d(\cdot)$ (DB)		DIRECTIVITY $d(\cdot)$ (NUMERIC)	DIRECTIVITY $d(\cdot)$ (DB)	
0.0000	0.00000	-INFINITY	-INFINITY	92.00000	0.64167	-1.92691
2.0000	0.01944	-17.11225	-21.01168	94.00000	0.58310	-2.34255
4.0000	0.07701	-11.13439	-15.03382	96.00000	0.52695	-2.78228
6.0000	0.17047	-7.68361	-11.58304	98.00000	0.47336	-3.24811
8.0000	0.29622	-5.28393	-9.19336	100.00000	0.42231	-3.74161
10.0000	0.44952	-3.47249	-7.37192	102.00000	0.37466	-4.26361
12.0000	0.62477	-2.04281	-5.94224	104.00000	0.33011	-4.81337
14.0000	0.81575	-0.88441	-4.78384	106.00000	0.28923	-5.38758
16.0000	1.01601	0.06897	-3.83046	108.00000	0.25243	-5.97863
18.0000	1.21911	0.86044	-3.03899	110.00000	0.22017	-6.57234
20.0000	1.41899	1.51978	-2.37965	112.00000	0.19297	-7.14509
22.0000	1.61011	2.06856	-1.83087	114.00000	0.17134	-7.66144
24.0000	1.78774	2.52305	-1.37638	116.00000	0.15580	-8.07432
26.0000	1.94803	2.89595	-1.00348	118.00000	0.14685	-8.33133
28.0000	2.08808	3.19746	-0.70197	120.00000	0.14491	-8.38898
30.0000	2.20595	3.43597	-0.46346	122.00000	0.15032	-8.22971
32.0000	2.30666	3.61852	-0.28091	124.00000	0.16328	-7.87069
34.0000	2.37202	3.75119	-0.14824	126.00000	0.18139	-7.35684
36.0000	2.42059	3.83922	-0.06021	128.00000	0.21164	-6.74413
38.0000	2.44752	3.88726	-0.01217	130.00000	0.24635	-6.08456
40.0000	2.45439	3.89943	0.00000	132.00000	0.28715	-5.41895
42.0000	2.44311	3.87943	0.02000	134.00000	0.33296	-4.77613
44.0000	2.41578	3.83057	0.06886	136.00000	0.38237	-4.17521
46.0000	2.37456	3.75833	-0.14360	138.00000	0.43367	-3.62844
48.0000	2.32161	3.65789	-0.24154	140.00000	0.48488	-3.14367
50.0000	2.25899	3.53915	-0.36028	142.00000	0.53381	-2.72610
52.0000	2.18863	3.40173	-0.49770	144.00000	0.57816	-2.37953
54.0000	2.11228	3.24752	-0.65191	146.00000	0.61559	-2.10711
56.0000	2.03149	3.07816	-0.82127	148.00000	0.64388	-1.91197
58.0000	1.94762	2.89504	-1.00439	150.00000	0.66107	-1.79754
60.0000	1.86182	2.69937	-1.20006	152.00000	0.66598	-1.76798
62.0000	1.77506	2.49212	-1.40731	154.00000	0.65638	-1.82843
64.0000	1.68813	2.27407	-1.62536	156.00000	0.63307	-1.98547
66.0000	1.60170	2.04580	-1.85363	158.00000	0.59600	-2.24757
68.0000	1.51625	1.80770	-2.09173	160.00000	0.54628	-2.62584
70.0000	1.43218	1.55998	-2.33945	162.00000	0.48583	-3.13511
72.0000	1.34979	1.30267	-2.59676	164.00000	0.41728	-3.79569
74.0000	1.26929	1.03562	-2.86381	166.00000	0.34386	-4.63619
76.0000	1.19082	0.75847	-3.14096	168.00000	0.26923	-5.69872
78.0000	1.11448	0.47071	-3.42872	170.00000	0.19730	-7.04870
80.0000	1.04031	0.17162	-3.72781	172.00000	0.13195	-8.79590
82.0000	0.96834	-0.13972	-4.03915	174.00000	0.07680	-11.14620
84.0000	0.89858	-0.46444	-4.36387	176.00000	0.03498	-14.56203
86.0000	0.83102	-0.80387	-4.70330	178.00000	0.00887	-20.51905
88.0000	0.76567	-1.15956	-5.05999	180.00000	0.00000	-INFINITY
90.0000	0.70254	-1.53327	-5.43270			

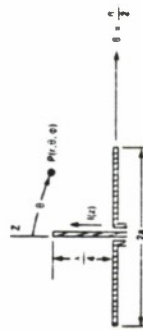


TABLE A3-3. DIRECTIVITY AND RADIATION RESISTANCE OF QUARTERWAVE MONOPOLE MOUNTED ON CIRCULAR
GROUNDPLANE OF FINITE EXTENT, $2\pi a/\lambda = 5.0$

$2\pi a/\lambda = 5.00$				radiation resistance = 32.5653 ohms			
ELEVATION ANGLE, θ (DEG)	DIRECTIVITY $d(\theta)$ (NUMERIC)	DIRECTIVITY $d(\theta)$ (DBI)	RELATIVE POWER (DB)	ELEVATION ANGLE, θ (DEG)	DIRECTIVITY $d(\theta)$ (NUMERIC)	DIRECTIVITY $d(\theta)$ (DBI)	RELATIVE POWER (DB)
0.0000	0.00000	-INFINITY	-INFINITY	92.0000	0.87449	-0.58246	-3.95421
2.0000	0.02482	-16.05208	-19.42383	94.0000	0.82949	-0.81188	-4.18363
4.0000	0.09782	-10.09571	-13.46746	96.0000	0.78534	-1.04941	-4.42116
6.0000	0.21476	-6.68050	-10.03225	98.0000	0.74175	-1.29741	-4.66916
8.0000	0.36897	-4.33006	-7.70181	100.0000	0.69841	-1.55892	-4.93067
10.0000	0.55196	-2.58096	-5.95271	102.0000	0.65499	-1.83766	-5.20941
12.0000	0.75406	-1.22596	-4.59771	104.0000	0.61120	-2.13818	-5.50993
14.0000	0.96524	-0.15364	-3.52539	106.0000	0.56678	-2.46583	-5.83758
16.0000	1.17584	0.70348	-2.68827	108.0000	0.52156	-2.82695	-6.19870
18.0000	1.37717	1.38988	-1.98187	110.0000	0.47546	-3.22886	-6.60061
20.0000	1.56207	1.93701	-1.43474	112.0000	0.42854	-3.68005	-7.05180
22.0000	1.72318	2.36835	-1.00340	114.0000	0.38105	-4.19022	-7.56197
24.0000	1.86308	2.70232	-0.66943	116.0000	0.33340	-4.77031	-8.14206
26.0000	1.97423	2.95399	-0.41776	118.0000	0.28627	-5.43226	-8.80401
28.0000	2.05878	3.13610	-0.23565	120.0000	0.24034	-6.18819	-9.55994
30.0000	2.11823	3.25972	-0.11203	122.0000	0.19733	-7.04807	-10.41982
32.0000	2.15506	3.33460	-0.03715	124.0000	0.15788	-8.01386	-11.38561
34.0000	2.17240	3.36939	-0.00236	126.0000	0.12400	-9.06566	-12.43741
36.0000	2.17358	3.37175	0.00000	128.0000	0.09699	-10.13272	-13.50448
38.0000	2.16190	3.34835	-0.02340	130.0000	0.07855	-11.04864	-14.42039
40.0000	2.14037	3.30488	-0.06687	132.0000	0.07016	-11.53903	-14.91078
42.0000	2.11155	3.24602	-0.12573	134.0000	0.07305	-11.36388	-14.73563
44.0000	2.07752	3.17544	-0.19631	136.0000	0.08801	-10.58472	-13.92647
46.0000	2.03979	3.09585	-0.27590	138.0000	0.11527	-9.38302	-12.75477
48.0000	1.99943	3.00905	-0.36270	140.0000	0.15432	-8.11571	-11.48746
50.0000	1.95708	2.91608	-0.45567	142.0000	0.20386	-6.90657	-10.27832
52.0000	1.91308	2.81734	-0.55441	144.0000	0.26171	-5.82188	-9.19363
54.0000	1.86757	2.71277	-0.65898	146.0000	0.32480	-4.88378	-8.25553
56.0000	1.82054	2.60201	-0.76974	148.0000	0.38938	-4.09623	-7.46798
58.0000	1.77196	2.48454	-0.88721	150.0000	0.45112	-3.45707	-6.82882
60.0000	1.72180	2.35982	-1.01193	152.0000	0.50545	-2.96325	-6.33500
62.0000	1.67008	2.22739	-1.14436	154.0000	0.54790	-2.61299	-5.98474
64.0000	1.61692	2.08689	-1.28486	156.0000	0.57434	-2.40678	-5.77853
66.0000	1.56249	1.93818	-1.43357	158.0000	0.58237	-2.34797	-5.71972
68.0000	1.50705	1.78127	-1.59048	160.0000	0.56971	-2.44350	-5.81525
70.0000	1.45090	1.61639	-1.75536	162.0000	0.53644	-2.70476	-6.07651
72.0000	1.39441	1.44390	-1.92785	164.0000	0.48425	-3.14928	-6.52103
74.0000	1.33793	1.26434	-2.10741	166.0000	0.41654	-3.80345	-7.17520
76.0000	1.28183	1.07831	-2.29344	168.0000	0.33825	-4.70757	-8.07932
78.0000	1.22644	0.88647	-2.48328	170.0000	0.25533	-5.92564	-9.29739
80.0000	1.17204	0.68944	-2.68231	172.0000	0.17513	-7.56629	-10.93804
82.0000	1.11887	0.48782	-2.88393	174.0000	0.10388	-9.83457	-13.20632
84.0000	1.06709	0.28202	-3.08793	176.0000	0.04795	-13.19224	-16.56399
86.0000	1.01679	0.07231	-3.29944	178.0000	0.01226	-19.11454	-22.48629
88.0000	0.96797	-0.14137	-3.51312	180.0000	0.00000	-INFINITY	-INFINITY
90.0000	0.92058	-0.35937	-3.73112				

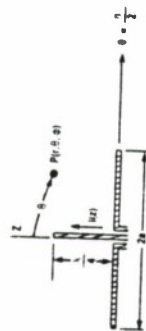


TABLE A3-4. DIRECTIVITY AND RADIATION RESISTANCE OF QUARTERWAVE MONOPOLE MOUNTED ON CIRCULAR GROUNDPLANE OF FINITE EXTENT, $2\pi a/\lambda = \sqrt{42}$

ELEVATION ANGLE, °	$2-a/\lambda = 6.48$		RELATIVE POWER (dB)	ELEVATION ANGLE, °	radiation resistance = 40.1666		RELATIVE POWER (dB)
	DIRECTIVITY $d(-)$ (NUMERIC)	DIRECTIVITY $d(-)$ (dB)			DIRECTIVITY $d(-)$ (NUMERIC)	DIRECTIVITY $d(-)$ (dB)	
0.0000	0.00000	-INFINITY	-INFINITY	92.0000	0.67231	-1.72428	-5.79331
2.0000	0.02090	-16.79764	-20.86667	94.0000	0.60756	-2.16409	-6.23312
4.0000	0.08056	-10.93877	-15.00780	96.0000	0.55213	-2.57960	-6.64863
6.0000	0.17036	-7.68624	-11.75527	98.0000	0.50596	-2.95882	-7.02785
8.0000	0.27774	-5.56365	-9.63228	100.0000	0.46895	-3.28869	-7.35772
10.0000	0.38842	-4.10697	-8.17600	102.0000	0.44091	-3.55647	-7.62350
12.0000	0.48900	-3.10694	-7.17597	104.0000	0.42153	-3.75175	-7.82078
14.0000	0.56920	-2.44734	-6.51637	106.0000	0.41033	-3.86868	-7.93771
16.0000	0.62359	-2.05104	-6.12007	108.0000	0.40664	-3.90789	-7.97692
18.0000	0.65226	-1.85579	-5.92482	110.0000	0.40953	-3.87714	-7.94617
20.0000	0.66065	-1.80030	-5.86933	112.0000	0.41776	-3.79075	-7.85778
22.0000	0.65833	-1.81553	-5.88456	114.0000	0.42975	-3.66784	-7.73687
24.0000	0.65732	-1.82220	-5.89123	116.0000	0.44359	-3.53020	-7.59923
26.0000	0.66999	-1.73930	-5.80833	118.0000	0.47004	-3.40044	-7.46947
28.0000	0.70715	-1.50491	-5.57394	120.0000	0.46764	-3.30084	-7.36987
30.0000	0.77647	-1.09876	-5.16779	122.0000	0.47283	-3.25299	-7.32202
32.0000	0.88155	-0.54752	-4.61655	124.0000	0.47011	-3.27797	-7.34700
34.0000	1.02161	0.09285	-3.97618	126.0000	0.45739	-3.39717	-7.46620
36.0000	1.19179	0.76201	-3.30702	128.0000	0.43317	-3.63342	-7.70245
38.0000	1.38401	1.41140	-2.65753	130.0000	0.39696	-4.01254	-8.08157
40.0000	1.58806	2.00867	-2.06036	132.0000	0.34951	-4.56539	-8.63442
42.0000	1.79284	2.53541	-1.53362	134.0000	0.29306	-5.33046	-9.39949
44.0000	1.98751	2.98310	-1.08593	136.0000	0.23140	-6.35645	-10.42548
46.0000	2.16247	3.34950	-0.71953	138.0000	0.16977	-7.70145	-11.77048
48.0000	2.31001	3.63614	-0.43289	140.0000	0.11453	-9.41087	-13.47990
50.0000	2.42471	3.84660	-0.22243	142.0000	0.07254	-11.39394	-15.46297
52.0000	2.50351	3.98550	-0.08353	144.0000	0.05038	-12.97752	-17.04655
54.0000	2.54561	4.05792	-0.01111	146.0000	0.03532	-12.73134	-16.80037
56.0000	2.55213	4.06903	0.00000	148.0000	0.02437	-10.73804	-14.80707
58.0000	2.52571	4.02384	-0.04519	150.0000	0.14342	-8.43399	-12.50302
60.0000	2.47012	3.92718	-0.14185	152.0000	0.22664	-6.44658	-10.51561
62.0000	2.38976	3.78355	-0.28548	154.0000	0.32649	-4.86135	-8.93038
64.0000	2.28936	3.59714	-0.47189	156.0000	0.43216	-3.64353	-7.71256
66.0000	2.17362	3.37184	-0.69719	158.0000	0.53081	-2.75063	-6.81966
68.0000	2.04701	3.11119	-0.95784	160.0000	0.60915	-2.15273	-6.22176
70.0000	1.91357	2.81845	-1.25058	162.0000	0.65552	-1.83417	-5.90320
72.0000	1.77689	2.49660	-1.57243	164.0000	0.66177	-1.79291	-5.86194
74.0000	1.63998	2.14840	-1.92063	166.0000	0.62500	-2.04117	-6.11020
76.0000	1.50536	1.77639	-2.29254	168.0000	0.54842	-2.60887	-6.67790
78.0000	1.37500	1.38304	-2.68599	170.0000	0.44133	-3.55241	-7.62144
80.0000	1.25048	0.97077	-3.09826	172.0000	0.31807	-4.97483	-9.04386
82.0000	1.13296	0.54214	-3.52689	174.0000	0.19602	-7.07709	-11.14612
84.0000	1.02328	0.09996	-3.96907	176.0000	0.09294	-10.31807	-14.38710
86.0000	0.92205	-0.35244	-4.42147	178.0000	0.02415	-16.17109	-20.24012
88.0000	0.82967	-0.81097	-4.88000	180.0000	0.00000	-INFINITY	-INFINITY
90.0000	0.74637	-1.27046	-5.33949				



APPENDIX A4. VARIATIONAL METHOD

	<u>Page</u>
Table A4-1; $28.0 < ka < \infty$, $h/\lambda = 0.25$	128

TABLE A4-1 .

$2\pi a/\lambda$	$R - R_{\infty}$ (OHMS)	$X - X_{\infty}$ (OHMS)	R (OHMS)	X (OHMS)	$d(\pi/2)$ (NUMERIC)	$D(\pi/2)$ (dBi)
28.2743340	-0.0428709	-1.0999534	36.4966393	20.1576080	0.8214043	-0.8544304
29.0597324	1.0697033	0.0411037	37.6092110	21.2986641	0.7971051	-0.9848440
29.8451309	-0.0340973	0.9679080	36.5054131	22.2254696	0.8212068	-0.8554745
30.6305294	-0.9435477	0.0328219	35.5959625	21.2903824	0.8421881	-0.7459092
31.4159279	-0.0364609	-0.9881375	36.5030479	20.2694225	0.8212600	-0.8551931
32.2013245	0.9636334	0.0351067	37.5031433	21.2926674	0.7993595	-0.9725786
32.9867249	-0.0294509	0.8773347	36.5100594	22.1348953	0.8211023	-0.8560272
33.7721214	-0.8572898	0.0284486	35.6822205	21.2860088	0.8401521	-0.7564207
34.5575218	-0.0314970	-0.8968816	36.5080109	20.3606796	0.8211484	-0.8557835
35.3429184	0.8766313	0.0304365	37.4161415	21.2879963	0.8012182	-0.9624919
36.1283150	-0.0257698	0.8023182	36.5137405	22.0598793	0.8210195	-0.8564651
36.9137154	-0.7855343	0.0249676	35.7539749	21.2825279	0.8384660	-0.7651453
37.6991119	-0.0275676	-0.8210008	36.5119400	20.4365597	0.8210601	-0.8562508
38.4845123	0.8039876	0.0267142	37.3434982	21.2842751	0.8027768	-0.9540519
39.2699089	-0.0228035	0.7391611	36.5167046	21.9967213	0.8209529	-0.8568177
40.0553093	-0.7249014	0.0221447	35.8146057	21.2797050	0.8370466	-0.7725036
40.8407059	-0.0243846	-0.7569175	36.5151253	20.5006428	0.8209884	-0.8566298
41.6261024	0.7424243	0.0236855	37.2819328	21.2812462	0.8041025	-0.9468860
42.4115028	-0.0203678	0.6852531	36.5191422	21.9428139	0.8208981	-0.8571074
43.1968994	-0.6729873	0.0198227	35.8665199	21.2773838	0.8358350	-0.7787943
43.9822998	-0.0217679	-0.7020830	36.5177422	20.5554771	0.8209296	-0.8569410
44.7676964	0.6895890	0.0211916	37.2290993	21.2787514	0.8052436	-0.9407272
45.5530930	-0.0183338	0.6386985	36.5211754	21.8962593	0.8208524	-0.8573493
46.3384933	-0.6280351	0.0178772	35.9114723	21.2754383	0.8347888	-0.7842339
47.1238899	-0.0195912	-0.6546321	36.5199165	20.6029282	0.8208807	-0.8571995
47.9092903	0.6437514	0.0191055	37.1832619	21.2766666	0.8062363	-0.9353768
48.6946869	-0.0166221	0.5980861	36.5228882	21.8556461	0.8208139	-0.8575531
49.4800873	-0.5887301	0.0162310	35.9507790	21.2737923	0.8338761	-0.7889849
50.2654839	-0.0177491	-0.6131703	36.5217590	20.6443901	0.8208393	-0.8574187
51.0508804	0.6036100	0.0173351	37.1431198	21.2748966	0.8071076	-0.9306855
51.8362808	-0.0151622	0.5623448	36.5243454	21.8199062	0.8207812	-0.8577261
52.6216774	-0.5540695	0.0148274	35.9854393	21.2723885	0.8330729	-0.7931700
53.4070778	-0.0161776	-0.5766323	36.5233307	20.6809292	0.8208039	-0.8576057
54.1924744	0.5681658	0.0158252	37.1076736	21.2733860	0.8078786	-0.9265392
54.9778748	-0.0139050	0.5306469	36.5256042	21.7882080	0.8207529	-0.8578759
55.7632713	-0.5232750	0.0136123	36.0162354	21.2711735	0.8323606	-0.7968851
56.5486679	-0.0148283	-0.5441912	36.5246811	20.7133694	0.8207736	-0.8577662
57.3340683	0.5366415	0.0145221	37.0761490	21.2720833	0.8085655	-0.9228480
58.1194649	-0.0128094	0.5023422	36.5266991	21.7599030	0.8207283	-0.8580059
58.9048653	-0.4957332	0.0125548	36.0437775	21.2701149	0.8317245	-0.8002049
59.6902618	-0.0136525	-0.5151959	36.5258560	20.7423649	0.8207472	-0.8579059
60.4756584	0.5084220	0.0133842	37.0479317	21.2709446	0.8091813	-0.9195414
61.2610588	-0.0118541	0.4769124	36.5276566	21.7344723	0.8207068	-0.8581198
62.0464554	-0.4709536	0.0116311	36.0685539	21.2691917	0.8311532	-0.8031892

TABLE A4-1 (cont.)

$2\pi a/\lambda$	$R - R_0$ (OHMS) $^\infty$	$X - X_0$ (OHMS) $^\infty$	R (OHMS)	X (OHMS)	d($\pi/2$) (NUMERIC)	D($\pi/2$) (dBi)
98.1747742	0.3115083	0.0064025	36.8510170	21.2639637	0.8135052	-0.8963966
98.9601746	-0.0058392	0.2968726	36.5336685	21.5544338	0.8205717	-0.8588346
99.7455673	-0.2945590	0.0057676	36.2449493	21.2633286	0.8271082	-0.8243767
100.5309677	-0.0061717	-0.3041370	36.5333366	20.9534245	0.8205792	-0.8587951
101.3163681	0.3017562	0.0061040	36.8412666	21.2636642	0.8137205	-0.8952473
102.1017609	-0.0055717	0.2878293	36.5339355	21.5453892	0.8205657	-0.8588665
102.8871613	-0.2856542	0.0055081	36.2538528	21.2630692	0.8269051	-0.8254435
103.6725616	-0.0058889	-0.2948331	36.5336189	20.9627285	0.8205728	-0.8588289
104.4579620	0.2925949	0.0058280	36.8321037	21.2633896	0.8139229	-0.8941671
105.2433548	-0.0053280	0.2793218	36.5341797	21.5368824	0.8205602	-0.8588954
106.0287552	-0.2772731	0.0052675	36.2622375	21.2628288	0.8267139	-0.8264478
106.8141556	-0.0056270	-0.2860803	36.5338821	20.9714813	0.8205669	-0.8588602
107.5995483	0.2839723	0.0055678	36.8234825	21.2631283	0.8141135	-0.8931505
108.3849487	-0.0051016	0.2713037	36.5344086	21.5288639	0.8205551	-0.8589226
109.1703491	-0.2693710	0.0050439	36.2701378	21.2626038	0.8265338	-0.8273939
109.9557495	-0.0053838	-0.2778310	36.5341263	20.9797306	0.8205614	-0.8588892
110.7411423	0.2758422	0.0053304	36.8153496	21.2628918	0.8142934	-0.8921910
111.5265427	-0.0048909	0.2637343	36.5346184	21.5212955	0.8205504	-0.8589475
112.3119431	-0.2619078	0.0048357	36.2775993	21.2623959	0.8263638	-0.8282872
113.0973358	-0.0051617	-0.2700431	36.5343475	20.9875183	0.8205565	-0.8569154
113.8827362	0.2681635	0.0051093	36.8076706	21.2626705	0.8144633	-0.8912850
114.6681366	-0.0046944	0.2565766	36.5348129	21.5141373	0.8205460	-0.8589709
115.4535370	-0.2548479	0.0046414	36.2846603	21.2622013	0.8262030	-0.8291324
116.2389297	-0.0049507	-0.2626789	36.5345573	20.9948826	0.8205518	-0.8589402
117.0243301	0.2608999	0.0049032	36.8004074	21.2624645	0.8146240	-0.8904280
117.8097305	-0.0045108	0.2497980	36.5349998	21.5073586	0.8205418	-0.8589929
118.5951233	-0.2481594	0.0044634	36.2913513	21.2620239	0.8260506	-0.8299333
119.3805237	-0.0047535	-0.2557049	36.5347557	21.0018559	0.8205473	-0.8589639
120.1659241	0.2540186	0.0047106	36.7935257	21.2622719	0.8147764	-0.8896159
120.9513168	-0.0043353	0.2433694	36.5351753	21.5009308	0.8205379	-0.8590138
121.7367172	-0.2418137	0.0042932	36.2976952	21.2618542	0.8259063	-0.8306924
122.5221176	-0.0045691	-0.2490909	36.5349388	21.0084705	0.8205432	-0.8589857
123.3075180	0.2474902	0.0045303	36.7869987	21.2620907	0.8149209	-0.8888455
124.0929108	-0.0041742	0.2372638	36.5353355	21.4948254	0.8205343	-0.8590326
124.8783112	-0.2357852	0.0041335	36.3037224	21.2616940	0.8257692	-0.8314133
125.6637115	-0.0043961	-0.2428097	36.5351143	21.0147514	0.8205392	-0.8590065
126.4491043	0.2412883	0.0043575	36.7807961	21.2619190	0.8150584	-0.8881130
127.2345047	-0.0040230	0.2314578	36.5354843	21.4890194	0.8205310	-0.8590504
128.0198975	-0.2300505	0.0039869	36.3094597	21.2615471	0.8256387	-0.8320996
128.8052979	-0.0042375	-0.2368367	36.5352707	21.0207233	0.8205357	-0.8590251
129.5906982	0.2353889	0.0041988	36.7748985	21.2617588	0.8151891	-0.8874166
130.3760986	-0.0038806	0.2259296	36.5356293	21.4834900	0.8205277	-0.8590677
131.1614990	-0.2245889	0.0038422	36.3149185	21.2614021	0.8255146	-0.8327526
131.9468994	-0.0040811	-0.2311501	36.5354271	21.0264111	0.8205322	-0.8590438
132.7322998	0.2297704	0.0040531	36.7692795	21.2616138	0.8153136	-0.8867530

TABLE A4-1 (cont.)

$2\pi a/\lambda$	$R - R_{\infty}$ (OHMS)	$X - X_{\infty}$ (OHMS)	R (OHMS)	X (OHMS)	$d(\pi/2)$ (NUMERIC)	$D(\pi/2)$ (dBi)
62.8318558	-0.0126236	-0.4891256	36.5268860	20.7684345	0.8207241	-0.8580283
63.6172523	0.4830137	0.0123905	37.0225220	21.2699509	0.8097367	-0.9165620
64.4026489	-0.0110089	0.4539403	36.5284996	21.7115002	0.8206878	-0.8582201
65.1880493	-0.4485402	0.0108128	36.0909691	21.2683735	0.8306370	-0.8058872
65.9734497	-0.0117172	-0.4655595	36.5277901	20.7920017	0.8207037	-0.8581358
66.7588425	0.4600173	0.0115103	36.9995270	21.2690716	0.8102400	-0.9138634
67.5442429	-0.0102629	0.4330855	36.5292473	21.6906471	0.8206710	-0.8583090
68.3296432	-0.4281690	0.0100862	36.1113396	21.2676468	0.8301684	-0.8083379
69.1150436	-0.0109139	-0.4441538	36.5285950	20.8134079	0.8206857	-0.8582314
69.9004364	0.4391052	0.0107323	36.9786148	21.2682934	0.8106982	-0.9114082
70.6858368	-0.0095979	0.4140679	36.5299110	21.6716290	0.8206561	-0.8583879
71.4712372	-0.4095726	0.0094376	36.1299362	21.2669983	0.8297411	-0.8105739
72.2566299	-0.0102046	-0.4246245	36.5293045	20.8329353	0.8206697	-0.8583160
73.0420303	0.4200068	0.0100381	36.9595146	21.2675991	0.8111171	-0.9091644
73.8274307	-0.0090020	0.3966545	36.5305061	21.6542149	0.8206428	-0.8584585
74.6128311	-0.3925286	0.0088557	36.1469803	21.2664165	0.8293499	-0.8126222
75.3982239	-0.0095630	-0.4067361	36.5299454	20.8508244	0.8206553	-0.8583920
76.1836243	0.4024961	0.0094156	36.9420052	21.2669754	0.8115016	-0.9071064
76.9690247	-0.0084656	0.3806503	36.5310440	21.6382103	0.8206307	-0.8585226
77.7544174	-0.3768499	0.0083369	36.1626587	21.2658978	0.8289903	-0.8145053
78.5398178	-0.0089857	-0.3902901	36.5305214	20.8672714	0.8206424	-0.8584604
79.3252182	0.3863834	0.0088547	36.9258919	21.2664146	0.8118557	-0.9052117
80.1106186	-0.0079807	0.3658908	36.5315285	21.6234512	0.8206198	-0.8585804
80.8960114	-0.3623789	0.0078620	36.1771317	21.2654228	0.8286587	-0.8162431
81.6814117	-0.0084639	-0.3751190	36.5310440	20.8824425	0.8206307	-0.8585226
82.4668121	0.3715079	0.0083475	36.9110184	21.2659073	0.8121828	-0.9034622
83.2522049	-0.0075354	0.3522363	36.5319748	21.6097965	0.8206097	-0.8586333
84.0376053	-0.3489809	0.0074307	36.1905289	21.2649918	0.8283519	-0.8178512
84.8230057	-0.0079905	-0.3610804	36.5315170	20.8964806	0.8206201	-0.8585787
85.6083984	0.3577328	0.0078812	36.8972435	21.2654419	0.8124861	-0.9018409
86.3937988	-0.0071347	0.3395666	36.5323753	21.5971279	0.8206007	-0.8586810
87.1791992	-0.3365408	0.0070373	36.2029686	21.2645988	0.8280673	-0.8193436
87.9645996	-0.0075594	-0.3480521	36.5319481	20.9095078	0.8206103	-0.8586302
88.7499924	0.3449399	0.0074616	36.8844490	21.2650223	0.8127679	-0.9003348
89.5353928	-0.0067684	0.3277787	36.5327415	21.5853386	0.8205925	-0.8587244
90.3207932	-0.3249591	0.0066775	36.2145500	21.2642384	0.8278025	-0.8207328
91.1061859	-0.0071708	-0.3359287	36.5323372	20.9216328	0.8206016	-0.8586765
91.8915863	0.3330283	0.0070780	36.8725357	21.2646389	0.8130305	-0.8989318
92.6769867	-0.0064327	0.3167838	36.5330772	21.5743446	0.8205850	-0.8587642
93.4623871	-0.3141500	0.0063474	36.2253571	21.2639084	0.8275555	-0.8220285
94.2477798	-0.0068096	-0.3246197	36.5326996	20.9329414	0.8205935	-0.8587194
95.0331802	0.3219100	0.0067261	36.8614197	21.2642860	0.8132756	-0.8976224
95.8185806	-0.0061239	0.3065044	36.5333862	21.5640659	0.8205780	-0.8588012
96.6039734	-0.3040383	0.0060481	36.2354698	21.2636089	0.8273246	-0.8232408
97.3893738	-0.0064776	-0.3140456	36.5330315	20.9435158	0.8205860	-0.8587589

TABLE A4-1 (cont.)

$2\pi a/\lambda$	$R - R_{\infty}$ (OHMS)	$X - X_{\infty}$ (OHMS)	R (OHMS)	X (OHMS)	$d(\pi/2)$ (NUMERIC)	$D(\pi/2)$ (dBi)
133.5176849	-0.0037433	0.2206601	36.5357666	21.4782200	0.8205246	-0.8590841
134.3030853	-0.2193809	0.0037124	36.3201294	21.2612724	0.8253961	-0.8333758
135.0884857	-0.0039409	-0.2257294	36.5355682	21.0318317	0.8205290	-0.8590605
135.8738861	0.2244135	0.0039089	36.7639236	21.2614689	0.8154324	-0.8861202
136.6592865	-0.0036202	0.2156310	36.5358887	21.4731922	0.8205218	-0.8590986
137.4446869	-0.2144097	0.0035835	36.3250999	21.2611446	0.8252832	-0.8339702
138.2300873	-0.0038018	-0.2205569	36.5357056	21.0370045	0.8205259	-0.8590769
139.0154724	0.2193003	0.0037729	36.7588081	21.2613335	0.8155459	-0.8855162
139.8008728	-0.0034976	0.2108267	36.5360107	21.4683876	0.8205191	-0.8591131
140.5862732	-0.2096590	0.0034680	36.3298492	21.2610283	0.8251753	-0.8345379
141.3716736	-0.0036771	-0.2156154	36.5358315	21.0419445	0.8205231	-0.8590918
142.1570740	0.2144142	0.0036510	36.7539215	21.2612114	0.8156543	-0.8849385
142.9424744	-0.0033878	0.2062321	36.5361214	21.4637928	0.8205166	-0.8591264
143.7278748	-0.2051150	0.0033526	36.3343925	21.2609138	0.8250721	-0.8350810
144.5132599	-0.0035593	-0.2108901	36.5359497	21.0466709	0.8205205	-0.8591059
145.2986603	0.2097409	0.0035293	36.7492485	21.2610893	0.8157580	-0.8843864
314.1591797	-0.0011151	-0.0965002	36.5383949	21.1610603	0.8204656	-0.8593965
314.9445801	0.0962590	0.0010780	36.6357689	21.2586384	0.8182849	-0.8709548
471.2387695	-0.0006121	-0.0642021	36.5388985	21.1933594	0.8204542	-0.8594564
472.0241699	0.0640954	0.0005776	36.6036034	21.2581387	0.8190039	-0.8671401
628.3183594	-0.0004024	-0.0480928	36.5391083	21.2094669	0.8204495	-0.8594813
629.1037598	0.0480331	0.0003687	36.5875435	21.2579288	0.8193634	-0.8652343
785.3981934	-0.0002733	-0.0384425	36.5392342	21.2191181	0.8204467	-0.8594962
786.1835938	0.0384038	0.0002777	36.5779114	21.2578392	0.8195792	-0.8640909
942.4777832	-0.0002102	-0.0320156	36.5392990	21.2255459	0.8204452	-0.8595040
943.2631836	0.0319889	0.0002084	36.5714989	21.2577686	0.8197229	-0.8633294
10**99	0.0000000	0.0000000	36.5395090	21.2575610	0.8204405	-0.85952902
INFINITY	0.0000000	0.0000000	36.5395090	21.2575610	3.2818500	5.16118730

APPENDIX A5. METHOD OF MOMENTS COMBINED WITH GEOMETRICAL
THEORY OF DIFFRACTION

	<u>Page</u>
Table A5-1; $2\pi a/\lambda = 20.0$, $h/\lambda = 0.25$, $b/\lambda = 10^{-6}$	134

TABLE A5-1

AWADALLA RESULT
 EPSLN= 20.0000000 (NORMALIZED GROUNDPLANE RADIUS)
 MONOPLE LENGTH= 0.2500000 (WAVELENGTH)
 MONOPLE RADIUS= 0.0000100 (WAVELENGTH)
 INPUT IMPEDANCE= 0.393019028E+02 + j 0.201706104E+02 (OHMS)

ELEVATION ANGLE (DEG)	DIRECTIVITY (NUMERIC)	DIRECTIVITY (dBi)	RELATIVE POWER (dB)	ELEVATION ANGLE (DEG)	DIRECTIVITY (NUMERIC)	DIRECTIVITY (dBi)	RELATIVE POWER (dB)
0	0.00000	-INFINITE	-INFINITE	45	0.47273	-3.25390	-9.30259
1	0.06796	-11.67747	-17.72616	46	0.41968	-3.77077	-9.81946
2	0.24612	-6.08851	-12.13720	47	0.39627	-4.02008	-10.06877
3	0.46721	-3.30488	-9.35356	48	0.39948	-3.98501	-10.03370
4	0.64815	-1.88322	-7.93190	49	0.42857	-3.67975	-9.72844
5	0.72163	-1.41685	-7.46554	50	0.48542	-3.13881	-9.18750
6	0.66119	-1.79673	-7.84542	51	0.57395	-2.41129	-8.45998
7	0.49049	-3.09366	-9.14235	52	0.69883	-1.55627	-7.60496
8	0.27358	-5.62909	-11.67778	53	0.86399	-0.63489	-6.68358
9	0.09050	-10.43371	-16.48240	54	1.07116	0.29855	-5.75014
10	0.00793	-21.00809	-27.05678	55	1.31888	1.20206	-4.84663
11	0.05607	-12.51250	-18.56119	56	1.60211	2.04591	-4.00177
12	0.21974	-6.58088	-12.62956	57	1.91237	2.81572	-3.23297
13	0.44608	-3.50587	-9.55456	58	2.23848	3.49953	-2.54916
14	0.66481	-1.77302	-7.82170	59	2.56756	4.09521	-1.95348
15	0.81272	-0.90058	-6.94927	60	2.88624	4.62332	-1.44536
16	0.85329	-0.68901	-6.73770	61	3.18178	5.02470	-1.02198
17	0.78509	-1.05078	-7.09947	62	3.44309	5.36949	-0.67920
18	0.63734	-1.95629	-8.00498	63	3.66141	5.63649	-0.41220
19	0.45585	-3.41174	-9.46043	64	3.83072	5.83280	-0.21988
20	0.28575	-5.44013	-11.48882	65	3.94784	5.96359	-0.08509
21	0.15747	-8.02805	-14.07674	66	4.01229	6.03393	-0.01476
22	0.08068	-10.93260	-16.98129	67	4.02595	6.04869	0.00000
23	0.04696	-13.28296	-19.33165	68	3.99261	6.01257	-0.03612
24	0.03888	-14.10309	-20.15178	69	3.91742	5.93000	-0.11869
25	0.04090	-13.88312	-19.93181	70	3.80641	5.80516	-0.24353
26	0.04763	-13.22128	-19.26997	71	3.66605	5.64198	-0.40671
27	0.06646	-11.77436	-17.82305	72	3.50277	5.44411	-0.60458
28	0.11410	-9.42717	-15.47585	73	3.32274	5.21496	-0.83373
29	0.20892	-6.80028	-12.84897	74	3.13158	4.95763	-1.09105
30	0.36230	-4.40930	-10.45799	75	2.93426	4.67499	-1.37370
31	0.57232	-2.42364	-8.47233	76	2.73502	4.36961	-1.67908
32	0.82178	-0.85246	-6.90115	77	2.53733	4.04378	-2.00491
33	1.08125	0.33926	-5.70943	78	2.34396	3.69949	-2.34919
34	1.31575	1.19172	-4.85697	79	2.15698	3.33846	-2.71023
35	1.49288	1.74024	-4.30845	80	1.97791	2.96206	-3.08663
36	1.59002	2.01404	-4.03465	81	1.80774	2.57137	-3.47732
37	1.59865	2.03752	-4.01116	82	1.64707	2.16712	-3.88157
38	1.52488	1.83236	-4.21632	83	1.49615	1.74974	-4.29855
39	1.38678	1.42007	-4.62862	84	1.35497	1.31929	-4.72940
40	1.20929	0.82529	-5.22339	85	1.22335	0.87551	-5.17318
41	1.01860	0.08005	-5.96864	86	1.10099	0.41782	-5.63087
42	0.83732	-0.77111	-6.81980	87	0.98749	0.05466	-6.10335
43	0.68137	-1.66615	-7.71484	88	0.88246	-0.54303	-6.59172
44	0.55920	-2.52435	-8.57304				

Table A5-1 (cont.)

AMADALLA RESULT
 EPSLN= 20.0000000 (NORMALIZED GROUNDPLANE RADIUS)
 MONOPLE LENGTH= 0.25000000 (WAVELENGTH)
 MONOPLE RADIUS= 0.00000100 (WAVELENGTH)
 INPUT IMPEDANCE= 0.393019028E+02 + j 0.201706104E+02 (OHMS)

ELEVATION ANGLE (DEG)	DIRECTIVITY (NUMERIC)	DIRECTIVITY (dBi)	RELATIVE POWER (dB)	ELEVATION ANGLE (DEG)	DIRECTIVITY (NUMERIC)	DIRECTIVITY (dBi)	RELATIVE POWER (dB)
89	0.78549	-1.04857	-7.09726	134	0.20692	-6.84207	-12.89075
90	0.69622	-1.57253	-7.62122	135	0.14450	-8.40143	-14.45012
91	0.61434	-2.11591	-8.16460	136	0.08112	-10.90860	-16.95728
92	0.53962	-2.67910	-8.72779	137	0.03067	-15.13315	-21.18184
93	0.47193	-3.26121	-9.30990	138	0.00458	-23.39319	-29.44189
94	0.41123	-3.85919	-9.90788	139	0.00877	-20.57190	-26.62059
95	0.35756	-4.46647	-10.51516	140	0.04160	-13.80860	-19.85729
96	0.31109	-5.07113	-11.11982	141	0.09375	-10.28045	-16.32914
97	0.27203	-5.65377	-11.70246	142	0.15012	-8.23576	-14.28444
98	0.24068	-6.18564	-12.23433	143	0.19379	-7.12669	-13.17537
99	0.21733	-6.62873	-12.67742	144	0.21090	-6.75930	-12.80799
100	0.20230	-6.94002	-12.98871	145	0.19511	-7.09717	-13.14586
101	0.19581	-7.08158	-13.13027	146	0.15030	-8.23055	-14.27923
102	0.19798	-7.03373	-13.08242	147	0.09012	-10.45171	-16.50040
103	0.20873	-6.80419	-12.85288	148	0.03442	-14.63222	-20.68091
104	0.22770	-6.42630	-12.47499	149	0.00300	-25.23113	-31.27982
105	0.25423	-5.94781	-11.99650	150	0.00881	-20.54938	-26.59806
106	0.28720	-5.41809	-11.46678	151	0.05272	-12.77989	-18.82858
107	0.32510	-4.87985	-10.92854	152	0.12206	-9.13432	-15.18301
108	0.36589	-4.36650	-10.41519	153	0.19391	-7.12389	-13.17258
109	0.40710	-3.90301	-9.95170	154	0.24268	-6.14973	-12.19842
110	0.44585	-3.50811	-9.55680	155	0.24939	-6.03114	-12.07983
111	0.47901	-3.19654	-9.24523	156	0.20970	-6.78402	-12.83271
112	0.50337	-2.98112	-9.02980	157	0.13696	-8.63419	-14.68288
113	0.51591	-2.87424	-8.92293	158	0.05879	-12.30668	-18.35537
114	0.51411	-2.88940	-8.93809	159	0.00757	-21.20760	-27.25629
115	0.49631	-3.04248	-9.09117	160	0.00782	-21.06523	-27.11391
116	0.46200	-3.35354	-9.40223	161	0.06544	-11.84184	-17.89052
117	0.41219	-3.84904	-9.89773	162	0.16323	-7.87204	-13.92073
118	0.34949	-4.56565	-10.61434	163	0.26562	-5.75747	-11.80616
119	0.27820	-5.55648	-11.60517	164	0.33154	-4.79458	-10.84327
120	0.20404	-6.90292	-12.95161	165	0.33138	-4.79670	-10.84538
121	0.13372	-8.73790	-14.78659	166	0.26114	-5.83118	-11.87987
122	0.07426	-11.29272	-17.34140	167	0.14774	-8.30502	-14.35371
123	0.03201	-14.94763	-20.99632	168	0.04190	-13.77805	-19.82674
124	0.01174	-19.30150	-25.35019	169	0.00020	-37.02296	-43.07164
125	0.01569	-18.04321	-24.09189	170	0.06237	-12.05005	-18.09874
126	0.04282	-13.68314	-19.73183	171	0.23273	-6.33144	-12.38013
127	0.08860	-10.52583	-16.57452	172	0.47380	-3.24409	-9.29278
128	0.14525	-8.37898	-14.42767	173	0.71599	-1.45095	-7.49964
129	0.20273	-6.93074	-12.97943	174	0.88100	-0.55025	-6.59894
130	0.25029	-6.01552	-12.06420	175	0.91069	-0.40631	-6.45500
131	0.27836	-5.55393	-11.60261	176	0.79043	-1.02138	-7.07007
132	0.28057	-5.51954	-11.56823	177	0.55740	-2.53837	-8.58706
133	0.25539	-5.92788	-11.97657	178	0.28966	-5.38113	-11.42982
134	0.20692	-6.84207	-12.89075	179	0.07440	-11.00158	-17.05026
135	0.14450	-8.40143	-14.45012	180	0.00000	-81.87164	-87.92033

APPENDIX B. LISTINGS OF COMPUTER PROGRAMS

	<u>Page</u>
B1 BARDEEN (Integral Equation)	139
B2 RICHMD1 and RICHMD2 (Method of Moments)	143
B3 MONOPL (Oblate Spheroidal Wave Functions)	179
B4 MONOSTOR (Variational Method)	199
B5 AWADALLA (Method of Moments Combined with Geometric Theory of Diffraction)	201

APPENDIX B1. LISTING OF PROGRAM "BARDEEN" (Integral Equation)

BARDEEN (1 of 3 pages)

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C
C      APPENDIX A .      PROGRAM "BARDEEN"
C*****
C
C      THE PROGRAM "BARDEEN", WRITTEN IN FORTRAN, COMPUTES
C      THE RADIATION RESISTANCE AND THE DIRECTIVE
C      GAIN FOR A MONOPOLE ELEMENT OF LENGTH, h, MOUNTED
C      AT THE CENTER OF AN ELECTRICALLY-SMALL CIRCULAR
C      GROUNDPLANE OF RADIUS, a, UTILIZING A BARDEEN-MITRE
C      INTEGRAL EQUATION METHOD.
C
C*****
C      THE INPUT VARIABLES OF THIS PROGRAM ARE:
C
C      L = 2πh/λ (ELEMENT LENGTH IN WAVENUMBERS)
C
C      ε = EPSLN = 2πa/λ (GROUNDPLANE RADIUS IN WAVENUMBERS)
C
C      WHERE
C      λ = EXCITATION WAVELENGTH
C
C*****
C      THE OUTPUT VARIABLES OF THIS PROGRAM ARE:
C
C      THETAD = θ, ELEVATION ANGLE (DEGREES)
C
C      RADRES = R, RADIATION RESISTANCE (DHMS)
C
C      DIREC = d(θ), DIRECTIVITY (NUMERIC)
C
C      DIRECO = D(θ), DIRECTIVITY (DBI)
C*****
C      REAL*8 Z,Z1,Z2,G,G1,G2,Y,Y1,Y2,F1(250),F2(250),T
C      REAL*8 I,Q,EPSLN,OCAORE,A,B,GSUM1,GSUM2,H,HEIGHT,L
C      REAL*8 TSUM1,TSUM2,TYSUM1,TYSUM2,BRKT1,YSUM1,YSUM2
C      REAL*8 BRKT2,BRKT(89),W(12),THTA(12),BRKT3,BRKT4,BRKT5
C      REAL*8 THETA(89),PI,CNVRT,MBRKT(89),DENOM
C      REAL*8 RAORES,DIREC(89),THETAD(89)
C      REAL*8 DIRECR(89),DIRECD(89),DIRMAX
C      PI=3.141592653600
C      L=PI/2.000
C      HEIGHT=L/(2*PI)
C*****
C      CONVERT DEGREE TO RADIAN*****
C      DO 1 II=1,89
C      K=II*2
C      THETAO(II)=DFLOAT(K)
C      THETA(II)=PI*THETAO(II)/180.000
C      1 CONTINUE
C*****
C      EPSLN=2.2500
C      DO 26 II=1,5
C*****
C      COMPUTE WITH RESPECT TO EVERY TWO DEGREE*****
C      DO 2 INDEX=1,89
C      K=1
C      T=0.00000100
C      IF (EPSLN.EQ.0.000) I=0.000
C      IF (EPSLN.EQ.0.000) Q=0.000

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      IF (EPSLN.EQ.O.OOO) GO TO 44
33  Z1=DSINH(T)*DSINH(EPSLN*DCDS(THETA(INDEX)))
    Z2=DSINH(EPSLN)*DSINH(T*OCOS(THETA(INDEX)))
    Z=(Z1-Z2)/OSINH(EPSLN)
    Y1=(H*DSINH(T)*OSIN(L)+T*DCDS(L)*DCDSH(T))/(L*L+T*T)
    Y2=OCOS(L)*DCOSH(T)/T
    Y=Y1-Y2
    G1=(DSINH(T)*OSIN(L)-T*DCDSH(T)*DSIN(L))/(T*T)
    G2=(T*DCDSH(T)*DSIN(L)-H*OSINH(T)*OCDS(L))/(L*L+T*T)
    G=G1+G2
    F1(K)=Z*Y
    F2(K)=Z*G
    T=T+O.O100
    K=K+1
    IF(T.LE.EPSLN)GO TO 33
    GSUM1=O.OOO
    YSUM1=O.OOO
    M=K-1
    DD 10 J=1,M
    YSUM1=YSUM1+F1(J)
    GSUM1=GSUM1+F2(J)
10  CONTINUE
    I=YSUM1*O.O1
    Q=GSUM1*O.O1
C*****COMPUTE RAOIATION RESISTANCE AND DIRECTIVE GAIN*****
44  BRKT3=OSIN(L*DCDS(THETA(INDEX)))-DCDS(THETA(INDEX))*DSIN(L)-
    *2.OOO*I/PI
    BRKT4=O.OOO
    BRKT5=O.OOO
    IF (EPSLN.EQ.O.OOO) GO TO 23
    BRKT4=OSIN(L)*OCOS(THETA(INDEX))
    BRKT5=DSIN(L)*DSINH(EPSLN*DCDS(THETA(INDEX)))/OSINH(EPSLN)
23  BRKT1=BRKT3+BRKT4-BRKT5
    BRKT2=OCDS(L*DCDS(THETA(INDEX)))-2.OOO*Q/PI-OCDS(L)
    BRKT(INDEX)=BRKT1*BRKT1+BRKT2*BRKT2
    MBRKT(INDEX)=BRKT(INDEX)/OSIN(THETA(INDEX))
2  CONTINUE
    DENOM=O.OOO
    DD 3 K=1,89
    OENOM=OENOM+MBRKT(K)
3  CONTINUE
    DENOM=DENOM*THETA(1)
    RADRES=14.98962514DO*DENOM/(DSIN(L)*DSIN(L))
    OIRMAX=O.OOO
    DD 4 K=1,89
    DIREC(K)=2.OOO*BRKT(K)/((DSIN(THETA(K)))*2.OOO*DENOM)
    DIRECD(K)=10.OO*OLOG10(DIREC(K))
    IF(OIRMAX.LT.OIRECO(K)) OIRMAX=DIRECO(K)
4  CONTINUE
    DD 15 J=1,89
    DIRECR(J)=DIRECO(J)-OIRMAX
15 CONTINUE
C*****WRITE STATMENTS*****
    WRITE(6,80)
80  FDMAT(1H1,'INTEGRAL EQUATION METHDD')
    WRITE(6,81) EPSLN
81  FORMAT(1X,'EPSILON= ',F6.4,'(NORMALIZED GROUNDPLANE RADIUS)')
    WRITE(6,82) HEIGHT
82  FDMAT(1X,'MONDPOLE LENGTH= ',F8.6,'(WAVELENGTH)')
    WRITE(6,83)
83  FORMAT(1X,'INFINITELY THIN MONDPOLE RADIUS')

```

BARDEEN (3 of 3 pages)

WRITE(6,84) RADRES	00001190
84 FDRMAT(1X,'RADIATION RESISTANCE = ',F10.6,' (DHMS)')	00001200
WRITE(6,85)	00001210
85 FDRMAT(//,1X,'ELEVATION',53X,'ELEVATIOND')	00001220
WRITE(6,86)	00001230
86 FORMAT(1X,2('ANGLE',6X,'DIRECTIVITY',5X,'DIRECTIVITY',5X	00001240
*, 'RELATIVE PDWER',5X))	00001250
WRITE(6,87)	00001260
87 FDRMAT(1X,2('(DEG)',6X,'(NUMERIC)',7X,'(DBI)',11X	00001270
*, '(DB)',15X))	00001280
WRITE(6,88)	00001290
88 FDRMAT(//,2X,' O. ',8X,'0.00000',5X,'-INFINITY',6X,'-INFINITY')	00001300
DO 16 L=1,44	00001310
WRITE(6,89) THETAD(L),DIREC(L),DIRECD(L),DIRECR(L)	00001320
*, THETAD(L+45),DIREC(L+45),DIRECD(L+45),DIRECR(L+45)	00001330
89 FDRMAT(1X,2(1X,F5.1,6X,F9.5,5X,F9.5,6X,F9.5,11X))	00001340
16 CONTINUE	00001350
WRITE(6,90) THETAD(45),DIREC(45),DIRECD(45),DIRECR(45)	00001360
90 FDRMAT(1X,1X,F5.1,6X,F9.5,5X,F9.5,6X,F9.5,12X,'180. '	00001370
*,8X,'0.00000',5X,'-INFINITY',6X,'-INFINITY')	00001380
EPSLN=EPSLN+0.25DO	00001390
26 CONTINUE	00001400
STDP	00001410
END	00001420

APPENDIX B2. LISTING OF PROGRAMS "RICHMD1" and "RICHMD2"
(Method of Moments)

	<u>Page</u>
RICHMD1 (Input impedance and current distributions)	144
RICHMD2 (Far-field radiation pattern)	174


```

C      PROGRAM "RICHMD1"
C*****
C      THIS COMPUTER PROGRAM, IN FORTRAN LANGUAGE, WAS WRITTEN BY
C      PROF. RICHMOND OF OHIO STATE UNIVERSITY. IT USES A SINUSOIDAL-
C      GALERKIN METHOD OF MOMENTS TO COMPUTE THE INPUT IMPEDANCE AND
C      THE CURRENT DISTRIBUTIONS OF A MONOPOLE ELEMENT OF LENGTH
C      h AND RADIUS b AT THE CENTER OF A CIRCULAR GROUNDPLANE OF RADIUS a.
C      A DETAILED DERIVATION IS PUBLISHED IN REFERENCE 1. IN
C      ORDER TO ADAPT THE PROGRAM INTO OUR COMPUTER SYSTEM
C      (VAX 11/780), THE PROGRAM HAS BEEN CHANGED FROM SINGLE PRECISION TO
C      DOUBLE PRECISION.
C
C      UTILIZING THE CURRENT DISTRIBUTIONS DETERMINED FROM THIS
C      PROGRAM, A RADIATION PATTERN CAN BE OBTAINED FROM THE MITRE
C      COMPUTER PROGRAM "RICHMD2". AN INPUT FILE, "INPUT1.DAT", TO THE
C      COMPUTER PROGRAM "RICHMD2" IS AUTOMATICALLY GENERATED FROM THIS
C      PROGRAM.
C
C      REFERENCE
C
C      1) J. H. RICHMOND, "MONOPOLE ANTENNA ON CIRCULAR DISK"
C          OHIO STATE UNIVERSITY, ELECTROSCIENCE LABORATORY,
C          TECHNICAL REPORT 711639-1, JULY 1979.
C*****
C      THIS COMPUTER PROGRAM REQUIRES SEVEN INPUTS WHICH ARE ENTERED
C      FROM AN INPUT FILE NAMED "MON.DAT" WITH FORMAT 17.
C
C          b = AL = MONOPOLE RADIUS IN WAVELENGTHS
C          h = HL = MONOPOLE LENGTH IN WAVELENGTHS
C       $\epsilon = 2\pi a / \lambda$  = EPSLN = NORMALIZED GROUNDPLANE RADIUS IN WAVENUMBERS
C           $b_1 / b$  = BAR = RATIO OF OUTER TO INNER CONDUCTOR RADII
C                      OF THE COAXIAL LINE FEED
C          N = NSW = NUMBER OF MONOPOLE SEGMENTS
C          M = NSD = NUMBER OF GROUNDPLANE CONCENTRIC ANNULAR ZONES
C          X = IX = NUMBER OF SUBDIVIDED ANNULAR ZONES FOR EACH NSD
C
C      NOTE: THE MAXIMUM NUMBER OF SEGMENTS (NSD+NSW) CAN BE USED IN
C      THIS PROGRAM IS 31. IF NUMBER OF SEGMENTS USED IS OVER
C      31, THEN ALL THE ARRAYS OF DIMENSION OF 30 AND 30x30
C      SHOULD BE CHANGED TO ARRAYS OF DIMENSION OF (NSD+NSW)
C      AND (NSD+NSW)x(NSD+NSW).
C*****
C      IMPLICIT REAL*8 (A-H), (P-Z)
C      COMPLEX*16 CJ(30), ZJ(30), VIJ(30,30), ZIJ(30,30), J11
C      COMPLEX*16 Y11, EC, D11, D12, D21, D22, DZ1J, DV1, W11
C      COMPLEX*16 P11, P12, P21, P22, ZDD, ZDM, ZMD, ZMM, Z11, ZD, Z22, Z12, Z21
C      DIMENSION FB(500)
C      OPEN(UNIT=4, FILE='INPUT1', STATUS='NEW')
C      OPEN(UNIT=9, FILE='RICH', STATUS='NEW')
C      OPEN(UNIT=6, FILE='MON.DAT', STATUS='OLD', READONLY)
C      DATA EO, UO/8. 85418533677E-12, 1. 25663706144E-6/
C      DATA ETA, PI, TP/376. 730366239, 3. 14159265359, 6. 28318530718/
C      DATA ICC, IFB/30, 500/
C      1  FORMAT(1X, 2I5, 2E15. 8)
C      2  FORMAT(/16X, 2F15. 4)
C      3  FORMAT(1X, 2I5, 4F10. 4)
C      5  FORMAT(1H0)
C*****
C      INPUTS
C

```

```

C*****
  READ(6, 17)AL, HL, EPSLN, BAR, NSD, NSW, IX
 17  FORMAT(3F12. 9, F6. 3, 3I2)
 101 BL=EPSLN/(2. *PI)
C*****
C      INPUT WRITE STATMENTS      *
C*****
 103 WRITE (9, 102)
 102 FORMAT (1H1, 14X, 'DOUBLE PRECISION')
      WRITE (9, 80) AL
 80  FORMAT (15X, 'MONOPOLE RADIUS(WAVELENGTH), AL= ', F15. 8)
      WRITE (9, 82) HL
 82  FORMAT (15X, 'MONOPOLE LENGTH(WAVELENGTH), HL= ', F5. 4)
      WRITE (9, 91) EPSLN
 91  FORMAT (15X, 'DISC RADIUS(WAVELENGTH), BL= ', G, '/(2*PI)')
      WRITE (9, 84) NSW
 84  FORMAT (15X, 'NUMBER OF MONOPOLE SEGMENTS, NSW= ', I2)
      WRITE (9, 85) NSD
 85  FORMAT (15X, 'NUMBER OF DISC SEGMENTS, NSD=', I2)
      WRITE (9, 88) BAR
 88  FORMAT (15X, 'COAXIAL RADIUS RATIO, BAR= ', F4. 2)
      NLI=NSD+NSW
      WRITE(4, 666)AL, HL, EPSLN, NSD, NSW, NLI, IX
 666 FORMAT(E12. 4, 2X, F8. 6, 2X, F6. 4, 2X, 4(I2, 2X))
 81  CONTINUE
      DO 400 IBL=10, 10
      TL=AL/100.
      IWCJ=1
      IZIJ=0
      IWZ=0
      NPH=6
      NEQ=NSD+NSW-1
      AK=TP*AL
      BK=TP*BL
      HK=TP*HL
      TK=TP*TL
      DKD=(BK-AK)/NSD
      DKW=HK/NSW
      RH2=AK+DKD
      IF(RH2. LT. BAR*AK)GO TO 400
      TDKD=2. *DKD
      CDKD=DCOS(DKD)
      SDKD=DSIN(DKD)
      CDK=DCOS(DKW)
      SDK=DSIN(DKW)
      MAX=NSW-1
      NA=NSD+1
      CALL GMM(AK, DKD, DKW, CDKD, SDKD, CDK, SDK, TK, IWZ, NPH, Z11)
      ZIJ(1, 1)=Z11
      IF(NSD. LE. 1)GO TO 100
      S1=AK
      DO 60 J=2, NSD
      S2=S1+DKD
      S3=S1+TDKD
      T1=AK
      DO 50 I=2, J
      T2=T1+DKD
      T3=T1+TDKD
      CALL QDD(CDKD, SDKD, S1, S3, T1, T3, TK, IWZ, NPH, Z22)
      ZIJ(I, J)=Z22
 50  T1=T1+DKD

```

```

        CALL GDM(AK, DKD, DKW, CDKD, SDK, S1, S3, TK, IWZ, NPH, Z12)
        ZIJ(1, J)=Z12
60      S1=S1+DKD
100     IF(NSW, LE. 1)GO TO 200
        CALL SPART(AK, DKD, DKW, MAX, IWZ, ZJ, CJ)
        L=0
        DO 160 I=NA, NEG
        DO 150 J=I, NEG
        K=J-I+1
150     ZIJ(I, J)=ZJ(K)
        L=L+1
        ZIJ(1, I)=CJ(L)
160     CONTINUE
178     IF(NSD, LE. 1)GO TO 200
        Z2=. ODO
        DO 190 J=NA, NEG
        Z2=Z2+DKW
        S1=Z2-DKW
        S3=Z2+DKW
        RH2=AK
        DO 180 I=2, NSD
        RH2=RH2+DKD
        T1=RH2-DKD
        T3=RH2+DKD
        CALL SKEWT(AK, S1, S3, T1, T3, CDK, SDK, CDKD, SDKD, IWZ, Z12)
180     ZIJ(I, J)=Z12
190     CONTINUE
200     CALL GRILL(AK, BAR, DKD, DKW, NEG, NSD, NSW, TK, CJ)
        DO 210 I=1, NEG
        DO 210 J=I, NEG
210     VIJ(I, J)=ZIJ(I, J)
C*****
C      MATRIX INVERSION FOR A NSW+NSD-1 BY NSW+NSD-1 SQUARE MATRIX *
C*****
        CALL CROUT(ZIJ, CJ, ICC, O, IWCJ, 1, NEG)
        Y11=CJ(1)
        Z11=1./Y11
320     CONTINUE
        J11=Z11
C*****
C      OUTPUT WRITE STATEMENTS *
C*****
400     CONTINUE
        WRITE(9, 92)
        WRITE(9, 93)
92      FORMAT (//15X, 'INPUT IMPEDANCE Z11 (OHMS)')
93      FORMAT (24X, 'RE(Z11)', 8X, 'IM(Z11)')
        WRITE(9, 2)J11
        CLOSE(UNIT=9, STATUS='KEEP')
        CLOSE(UNIT=6, STATUS='KEEP')
500     CALL EXIT
        END

```

```

C*****
C      SUBROUTINE CISI
C*****
      SUBROUTINE CISI(CI,CIN,SI,X)
      IMPLICIT REAL*8 (A-H), (P-Z)
      DATA GAM,P2/.57721566,1.57079632/
      A=DABS(X)
      IF(A.GT.4.)GO TO 10
      IF(A.GT.1.)GO TO 3
      IF(A.GT.0.)GO TO 2
      CI=.ODO
      CIN=.ODO
      SI=.ODO
      RETURN
2     X2=A*A
      SI=X*((.03*X2-1.)*X2/18.+1.)
      CIN=.25*X2*((X2/45.-1.)*X2/24.+1.)
      GO TO 8
3     Y=(4.-A)*(4.+A)
      SI=X*(((1.753141E-9*Y+1.568988E-7)*Y+1.374168E-5)*Y+6.939889E-4)
      C*Y+1.964882E-2)*Y+4.395509E-1)
      CIN=      A*A*(((1.386985E-10*Y+1.584996E-8)*Y
      C+1.725752E-6)*Y+1.185999E-4)*Y+4.990920E-3)*Y+1.315308E-1)
8     CI=GAM+DLOG(A)-CIN
      RETURN
10    SI=DSIN(A)
      Y=DCOS(A)
      Z=4./A
      U=(((((((4.048069E-3*Z-2.279143E-2)*Z+5.515070E-2)*Z-7.261642E-2)
      C*Z+4.987716E-2)*Z-3.332519E-3)*Z-2.314617E-2)*Z-1.134958E-5)*Z
      C+6.250011E-2)*Z+2.583989E-10
      V=((((((((-5.108699E-3*Z+2.819179E-2)*Z-6.537283E-2)*Z
      C+7.902034E-2)*Z-4.400416E-2)*Z-7.945556E-3)*Z+2.601293E-2)*Z
      C-3.764000E-4)*Z-3.122418E-2)*Z-6.646441E-7)*Z+2.500000E-1
      CI=Z*(SI*V-Y*U)
      SI=-Z*(SI*U+Y*V)+P2
      IF(X.LT..ODO)SI=-SI
      CIN=GAM+DLOG(A)-CI
      RETURN
      END

```



```

C*****
C      SUBROUTINE CROUT                                     *
C*****
      SUBROUTINE CROUT(C, S, ICC, ISYM, IWR, I12, N)
      IMPLICIT REAL*8 (A-H), (P-Z)
      COMPLEX*16 C(ICC, ICC), S(1)
      COMPLEX*16 F, P, SS, T
1     FORMAT(15X, 'LIST OF THE LOOP CURRENTS CJ(I)')
2     FORMAT(5X, 'I', 3X, 'MAGNITUDE', 3X, 'PHASE', 5X, 'REAL'
2, 5X, 'IMAGINARY')
3     FORMAT(1X, I5, F10.4, F10.1, 2E12.4)
5     FORMAT(1H0)
      IF(I12.NE.1)GO TO 22
      IF(N.EQ.1)S(1)=S(1)/C(1,1)
      IF(N.EQ.1)GO TO 39
      IF(ISYM.NE.0DO)GO TO 8
      DO 6 I=1, N
      DO 6 J=I, N
6     C(J, I)=C(I, J)
8     F=C(1, 1)
      DO 10 L=2, N
10    C(1, L)=C(1, L)/F
      DO 20 L=2, N
      LLL=L-1
      DO 20 I=L, N
      F=C(I, L)
      DO 11 K=1, LLL
11    F=F-C(I, K)*C(K, L)
      C(I, L)=F
      IF(L.EQ.1)GO TO 20
      P=C(L, L)
      IF(ISYM.EQ.0DO)GO TO 15
      F=C(L, I)
      DO 12 K=1, LLL
12    F=F-C(L, K)*C(K, I)
      C(L, I)=F/P
      GO TO 20
15    F=C(I, L)
      C(L, I)=F/P
20    CONTINUE
22    DO 30 L=1, N
      P=C(L, L)
      T=S(L)
      IF(L.EQ.1)GO TO 30
      LLL=L-1
      DO 25 K=1, LLL
25    T=T-C(L, K)*S(K)
30    S(L)=T/P
      DO 38 L=2, N
      I=N-L+1
      II=I+1
      T=S(I)
      DO 35 K=II, N
35    T=T-C(I, K)*S(K)
38    S(I)=T
39    IF(IWR.LE.0DO) GO TO 100
      WRITE(9, 5)
      WRITE(9, 1)
      WRITE(9, 2)
      CNDR=.0DO
      DO 40 I=1, N

```

RICHMD1 (6 of 30 pages)

```
      SA=CDABS(S(I))
40  IF(SA.GT.CNOR)CNOR=SA
      IF(CNOR.LE.O.)CNOR=1.
      DO 44 I=1,N
      SS=S(I)
      SA=CDABS(SS)
      SNOR=SA/CNOR
      PH=.ODO
      IF(SA.GT.O.)PH=57.29578*DATAN2(DIMAG(SS),DREAL(SS))
      WRITE(9,3)I,SNOR,PH,SS
44  WRITE(4,111)SS
111  FORMAT(2E12.4)
      WRITE(9,5)
100  RETURN
      END
```

```

C*****
C      SUBROUTINE EXPJ                                     *
C*****
      SUBROUTINE EXPJ(V1,V2,W12)
      IMPLICIT REAL*8 (A-H), (P-Z)
      COMPLEX*16 EC,E15,S,T,UC,VC,V1,V2,W12,Z
      DIMENSION V(21),W(21),D(16),E(16)
      DATA V/ 0.22284667E 00,
20. 11889321E 01, 0.29927363E 01, 0.57751436E 01, 0.98374674E 01,
20. 15982874E 02, 0.93307812E-01, 0.49269174E 00, 0.12155954E 01,
20. 22699495E 01, 0.36676227E 01, 0.54253366E 01, 0.75659162E 01,
20. 10120228E 02, 0.13130282E 02, 0.16654408E 02, 0.20776479E 02,
20. 25623894E 02, 0.31407519E 02, 0.38530683E 02, 0.48026086E 02/
      DATA W/ 0.45896460E 00,
20. 41700083E 00, 0.11337338E 00, 0.10399197E-01, 0.26101720E-03,
20. 89854791E-06, 0.21823487E 00, 0.34221017E 00, 0.26302758E 00,
20. 12642582E 00, 0.40206865E-01, 0.85638778E-02, 0.12124361E-02,
20. 11167440E-03, 0.64599267E-05, 0.22263169E-06, 0.42274304E-08,
20. 39218973E-10, 0.14565152E-12, 0.14830270E-15, 0.16005949E-19/
      DATA D/ 0.22495842E 02,
2 0.74411568E 02, -0.41431576E 03, -0.78754339E 02, 0.11254744E 02,
2 0.16021761E 03, -0.23862195E 03, -0.50094687E 03, -0.68487854E 02,
2 0.12254778E 02, -0.10161976E 02, -0.47219591E 01, 0.79729681E 01,
2-0.21069574E 02, 0.22046490E 01, 0.89728244E 01/
      DATA E/ 0.21103107E 02,
2-0.37959787E 03, -0.97489220E 02, 0.12900672E 03, 0.17949226E 02,
2-0.12910931E 03, -0.55705574E 03, 0.13524801E 02, 0.14696721E 03,
2 0.17949528E 02, -0.32981014E 00, 0.31028836E 02, 0.81657657E 01,
2 0.22236961E 02, 0.39124892E 02, 0.81636799E 01/
      Z=V1
      DO 100 JIM=1,2
      X=DREAL(Z)
      Y=DIMAG(Z)
      E15=(.0D0,.0D0)
      AB=CDABS(Z)
      IF(AB.EQ.0.)GO TO 90
      IF(X.GE.0. .AND. AB.GT.10.)GO TO 80
      YA=DABS(Y)
      IF(X.LE.0. .AND. YA.GT.10.)GO TO 80
      IF(YA-X.GE.17.5.OR. YA.GE.6.5.OR. X+YA.GE.5.5.OR. X.GE.3.)GO TO 20
      IF(X.LE.-9.)GO TO 40
      IF(YA-X.GE.2.5)GO TO 50
      IF(X+YA.GE.1.5)GO TO 30
10  N=6.+3.*AB
      E15=1./(N-1.)*Z/N**2
15  N=N-1
      E15=1./(N-1.)*Z*E15/N
      IF(N.GE.3)GO TO 15
      E15=Z*E15-DCMPLX(.577216+DLOG(AB),DATAN2(Y,X))
      GO TO 90
20  J1=1
      J2=6
      GO TO 31
30  J1=7
      J2=21
31  S=(.0D0,.0D0)
      YS=Y*Y
      DO 32 I=J1,J2
      XI=V(I)+X
      CF=W(I)/(XI*XI+YS)
32  S=S+DCMPLX(XI*CF,-YA*CF)

```

```

      GO TO 54
40  T3=X*X-Y*Y
      T4=2.*X*YA
      T5=X*T3-YA*T4
      T6=X*T4+YA*T3
      UC=DCMPLX(D(11)+D(12)*X+D(13)*T3+T5-E(12)*YA-E(13)*T4,
2  E(11)+E(12)*X+E(13)*T3+T6+D(12)*YA+D(13)*T4)
      VC=DCMPLX(D(14)+D(15)*X+D(16)*T3+T5-E(15)*YA-E(16)*T4,
2  E(14)+E(15)*X+E(16)*T3+T6+D(15)*YA+D(16)*T4)
      GO TO 52
50  T3=X*X-Y*Y
      T4=2.*X*YA
      T5=X*T3-YA*T4
      T6=X*T4+YA*T3
      T7=X*T5-YA*T6
      T8=X*T6+YA*T5
      T9=X*T7-YA*T8
      T10=X*T8+YA*T7
      UC=DCMPLX(D(1)+D(2)*X+D(3)*T3+D(4)*T5+D(5)*T7+T9-(E(2)*YA+E(3)*T4
2+E(4)*T6+E(5)*T8), E(1)+E(2)*X+E(3)*T3+E(4)*T5+E(5)*T7+T10+
3(D(2)*YA+D(3)*T4+D(4)*T6+D(5)*T8))
      VC=DCMPLX(D(6)+D(7)*X+D(8)*T3+D(9)*T5+D(10)*T7+T9-(E(7)*YA+E(8)*T4
2+E(9)*T6+E(10)*T8), E(6)+E(7)*X+E(8)*T3+E(9)*T5+E(10)*T7+T10+
3(D(7)*YA+D(8)*T4+D(9)*T6+D(10)*T8))
52  EC=UC/VC
      S=EC/DCMPLX(X, YA)
54  EX=DEXP(-X)
      T=EX*DCMPLX(DCOS(YA), -DSIN(YA))
      E15=S*T
56  IF(Y.LT.0.)E15=DCONJG(E15)
      GO TO 90
80  E15=.409319/(Z+.193044)+.421831/(Z+1.02666)+.147126/(Z+2.56788)+
2.206335E-1/(Z+4.90035)+.107401E-2/(Z+8.18215)+.158654E-4/(Z+
312.7342)+.317031E-7/(Z+19.3957)
      E15=E15*CDEXP(-Z)
90  IF(JIM.EQ.1)W12=E15
100 Z=V2
      Z=V2/V1
      TH=DATAN2(DIMAG(Z), DREAL(Z))-DATAN2(DIMAG(V2), DREAL(V2))
      TH=DATAN2(DIMAG(V1), DREAL(V1))
      AB=DABS(TH)
      IF(AB.LT.1.)TH=.0D0
      IF(TH.GT.1.)TH=6.2831853
      IF(TH.LT.-1.)TH=-6.2831853
      W12=W12-E15+DCMPLX(.0D0, TH)
      RETURN
      END

```



```

C*****
C      SUBROUTINE GRILL                                     *
C*****
      SUBROUTINE GRILL(AK, BAR, DKD, DKW, NEG, NSD, NSW, TK, VJ)
      IMPLICIT REAL*8 (A-H), (P-Z)
      COMPLEX*16 EGZ, GM, GP, GI(20), VJ(1), GII, GST, WST, VJ1
      DOUBLE PRECISION DZS, RS1, RS2
      DATA PI, TP/3.14159265359, 6.28318530718/
      IDM=20
      DO 20 I=1, NEG
20    VJ(I)=(.ODO, .ODO)
      VJ(1)=(1., .ODO)
      IF(BAR. LE. 1.)RETURN
      VJ(1)=(.ODO, .ODO)
      DK=DKW
      SDK=DSIN(DK)
      CDK=DCOS(DK)
      BAL=DLOG(BAR)
      GST=DCMPLX(.ODO, 1./(4.*BAL*SDK))
      BK=AK*BAR
      AKS=AK*AK
      BKS=BK*BK
      LIM=NSW+1
      IF(LIM. GT. IDM)LIM=IDM
      NPH=6
      NPH=2*(NPH/2)
      NPP=NPH+1
      PHA=.0174533*20.
      DPH=PHA/NPH
      PH=.ODO
      DO 90 LPH=1, 2
      WST=DPH*GST/(3.*PI)
      SGN=-1.
      DO 80 IPH=1, NPP
      WF=3.+SGN
      IF(IPH. EQ. 1)WF=1.
      IF(IPH. EQ. NPP)WF=1.
      CPH=DCOS(PH)
      IF(IPH. GT. 1)GO TO 40
      IF(LPH. GT. 1)GO TO 40
      CPH=DCOS(DPH/10.)
40    RS1=2.*AKS*(1.-CPH)
      RS2=AKS+BKS-2.*AK*BK*CPH
      RH1=DSQRT(RS1)
      RH2=DSQRT(RS2)
      CALL CISI(CA, CIN, SA, RH1)
      CALL CISI(CB, CIN, SB, RH2)
      GI(1)=2.*DCMPLX(CB-CA, SA-SB)
      DO 50 I=2, LIM
      DZ=DK*(I-1)
      DZS=DZ*DZ
      RA=DSQRT(RS1+DZS)
      RB=DSQRT(RS2+DZS)
      CALL CISI(C1, CIN, S1, RA+DZ)
      CALL CISI(C2, CIN, S2, RB+DZ)
      GP=DCMPLX(C2-C1, S1-S2)
      RAM=RS1/(RA+DZ)
      RBM=RS2/(RB+DZ)
      CALL CISI(C1, CIN, S1, RAM)
      CALL CISI(C2, CIN, S2, RBM)
      GM=DCMPLX(C2-C1, S1-S2)

```

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```
      EGZ=DCMLX(DCOS(DZ), DSIN(DZ))
50    GI(1)=GP*EGZ+GM/EGZ
      VJ(1)=VJ(1)+WF*WST*(GI(2)-CDK*GI(1))
      IF(NSW.LE.1)GO TO 78
      K1=0
      IA=NSD+1
      DO 60 I=IA, NEG
      K1=K1+1
      K2=K1+1
      K3=K2+1
      IF(K3.GT.IDM)GO TO 60
      GP=GI(K1)-2.*CDK*GI(K2)+GI(K3)
      VJ(I)=VJ(I)+WF*WST*GP
60    CONTINUE
78    SGN=-SGN
80    PH=PH+DPH
      DPH=(PI-PHA)/NPH
90    PH=PHA
      CALL CISI(CA,CIN,SA,AK)
      CALL CISI(CB,CIN,SB,BK)
      R2=AK+DKD
      SR2=DSIN(R2)
      CR2=DCOS(R2)
      SDKD=DSIN(DKD)
      V11=(SR2*(CB-CA)-CR2*(SB-SA))/(2.*BAL*SDKD)
      VJ(1)=V11+VJ(1)
      IF(NSD.LE.1)RETURN
      V22=(DSIN(AK)*(CB-CA)-DCOS(AK)*(SB-SA))/(2.*BAL*SDKD)
      VJ(2)=DCMLX(V22,.ODO)
      RETURN
      END
```

```

C*****
C      SUBROUTINE GDD
C*****
      SUBROUTINE GDD(CDKD,SDKD,S1,S3,T1,T3,TK,IWZ,NPH,Z22)
      IMPLICIT REAL*8 (A-H), (P-Z)
      COMPLEX*16 Z12,Z22,ZD
      DATA PI,P3/3.14159265359,9.42477796077/
2     FORMAT(1X,BF10.2)
5     FORMAT(1H0)
6     FORMAT(5X,'PRINTOUT FROM GDD')
7     FORMAT(5X,'DISK DIPOLE TO DISK DIPOLE')
      IF(IWZ.LE.0)GO TO 10
      WRITE(8,6)
      WRITE(8,7)
      WRITE(8,5)
10    PHA=.0174533*2.
      PHB=.0174533*20.
      NPH=2*(NPH/2)
      DPH=PHA/NPH
      PH=.ODO
      NPHP=NPH+1
      Z22=(.ODO,.ODO)
      DO 80 IPH=1,3
      ZD=(.ODO,.ODO)
      SGI=-1.
      DO 70 I=1,NPHP
      WF=3.+SGI
      IF(I.EQ.1)WF=1.
      IF(I.EQ.NPHP)WF=1.
      CPH=DCOS(PH)
      IF(I.EQ.1 .AND. IPH.GT.1)GO TO 60
C  NEXT:  DISK DIPOLE TO DISK DIPOLE.
      CALL SKEWS(S1,S3,T1,T3,TK,CDKD,SDKD,CDKD,SDKD,CPH,Z12)
60    PHD=57.29578*PH
      IF(IWZ.GT.ODO)WRITE(8,2)PHD,Z12
      SGI=-SGI
      PH=PH+DPH
70    ZD=ZD+WF*Z12
      Z22=Z22+DPH*ZD/P3
      PH=PHA
      DPH=(PHB-PHA)/NPH
      IF(IPH.EQ.1)GO TO 80
      PH=PHB
      DPH=(PI-PHB)/NPH
80    CONTINUE
      IF(IWZ.GT.ODO)WRITE(8,5)
      RETURN
      END

```

RICHMD1 (12 of 30 pages)

```

C*****
C      SUBROUTINE GDM
C*****
      SUBROUTINE GDM(AK, DKD, DKW, CDKD, SDKD, SDK, S1, S3, TK, IWZ, NPH, Z12)
      IMPLICIT REAL*8 (A-H), (P-Z)
      COMPLEX*16 ZD, Z12, Z21, ZDM, ZM, P12, ZDD, PDM
      DATA PI, P3/3.14159265359, 9.42477796077/
      2  FORMAT(1X, BF10.2)
      5  FORMAT(1H0)
      6  FORMAT(5X, 'PRINTOUT FROM GDM')
      7  FORMAT(5X, 'DISK DIPOLE TO DISK MONOPOLE')
      8  FORMAT(5X, 'DISK DIPOLE TO WIRE MONOPOLE')
      IF(IWZ.LE.0)GO TO 10
      WRITE(8,6)
      WRITE(8,7)
      WRITE(8,5)
      10 PHA=.0174533*2.
      PHB=.0174533*20.
      NPH=2*(NPH/2)
      NPHP=NPH+1
      DPH=PHA/NPH
      IDM=1
      IF(S1.GT.10.*AK)IDM=0
      PH=.ODO
      ZDD=(.ODO,.ODO)
      T2=AK+DKD
      DO 40 IPH=1,3
      ZD=(.ODO,.ODO)
      SGI=-1.
      DO 30 I=1, NPHP
      WF=3.+SGI
      IF(I.EQ.1)WF=1.
      IF(I.EQ.NPHP)WF=1.
      CPH=DCOS(PH)
      IF(I.EQ.1.AND. IPH.GT.1)GO TO 20
C  NEXT:  DISK-DIPOLE TO DISK-MONOPOLE.
      CALL ZSDM(S1, S3, AK, T2, TK, CDKD, SDKD, SDK, CPH, P12)
      20 PHD=57.29578*PH
      IF(IWZ.GT.0)WRITE(8,2)PHD, P12
      SGI=-SGI
      PH=PH+DPH
      30 ZD=ZD+WF*P12
      ZDD=ZDD+DPH*ZD/P3
      PH=PHA
      DPH=(PHB-PHA)/NPH
      IF(IPH.EQ.1)GO TO 40
      PH=PHB
      DPH=(PI-PHB)/NPH
      40 CONTINUE
      IF(IWZ.GT.0)WRITE(8,5)
      W2=TK+DKW
      IF(IDM.EQ.0)GO TO 100
      IF(IWZ.GT.0)WRITE(8,8)
      LPH=6
      LPH=2*(LPH/2)
      LPP=LPH+1
      PHA=.0174533*20.
      DPH=PHA/LPH
      PH=.ODO
      ZDM=(.ODO,.ODO)
      RMN=AK/100.

```


RICHMD1 (13 of 30 pages)

```
      DO 90 IPH=1,2
      PDM=(.ODO,.ODO)
      SGI=-1.
      DO 80 I=1,LPP
      WF=3.+SGI
      IF(I.EQ.1)WF=1.
      IF(I.EQ.LPP)WF=1.
      CPH=DCOS(PH)
      RH=AK*DSIN(PH)
      IF(I.EQ.1)RH=RMN
      AC=AK*CPH
      V1=S1-AC
      V3=S3-AC
      IF(I.EQ.1.AND. IPH.GT.1)GO TO 70
C   NEXT:  DISK-DIPOLE TO WIRE-MONOPOLE.
      CALL ZSDM(V1,V3,TK,W2,RH,CDKD,SDKD,SDK,.ODO,P12)
70  PHD=57.29578*PH
      IF(IWZ.GT.ODO)WRITE(8,2)PHD,P12
      SGI=-SGI
      PH=PH+DPH
80  PDM=PDM+WF*P12
      ZDM=ZDM+DPH*PDM/P3
      DPH=(PI-PHA)/LPH
90  PH=PHA
      Z12=ZDM-ZDD
      IF(IWZ.GT.ODO)WRITE(8,5)
      RETURN
C   NEXT:  DISK-DIPOLE TO WIRE-MONOPOLE.
100 CALL ZSDM(S1,S3,TK,W2,AK,CDKD,SDKD,SDK,.ODO,ZDM)
      Z12=ZDM-ZDD
      RETURN
      END
```

```

C*****
C      SUBROUTINE GMM
C*****
      SUBROUTINE GMM(AK,DKD,DKW,CDKD,SDKD,CDK,SDK,TK,IWZ,NPH,Z11)
      IMPLICIT REAL*8 (A-H), (P-Z)
      COMPLEX*16 FDM,FMD,FMM,PDM,PMD,PMM
      COMPLEX*16 ZD,ZDD,ZDM,ZMD,ZMM,Z11,P11
      DOUBLE PRECISION DRG
      DATA P1,P3/3.14159265359,9.42477796077/
      1  FORMAT(1X,8F8.0)
      2  FORMAT(1X,8F10.2)
      5  FORMAT(1H0)
      6  FORMAT(5X,'PRINTOUT FROM GMM')
      7  FORMAT(5X,'DISK MONOPOLE TO DISK MONOPOLE')
      IF(IWZ.LE.0)GO TO 10
      WRITE(8,6)
      WRITE(8,5)
      10  AKS=AK*AK
          DKMP=TK+DKW
          CDKMP=DCOS(DKMP)
          SDKMP=DSIN(DKMP)
          ZMM=(.ODO,.ODO)
          ZMD=(.ODO,.ODO)
          ZDM=(.ODO,.ODO)
          LPH=6
          LPH=2*(LPH/2)
          LPP=LPH+1
          PHA=.0174533*20.
          DPH=PHA/LPH
          RMN=AK*DPH/10.
          PH=.ODO
          DO 44 IPH=1,2
          FDM=(.ODO,.ODO)
          FMD=(.ODO,.ODO)
          FMM=(.ODO,.ODO)
          SGI=-1.
          DO 40 I=1,LPP
          WF=3.+SGI
          IF(I.EQ.1)WF=1.
          IF(I.EQ.LPP)WF=1.
          IF(I.EQ.1 .AND. IPH.GT.1)GO TO 38
          CPH=DCOS(PH)
          SPH=DSIN(PH)
          DRG=2.*(1.-CPH)
          R=AK*DSQRT(DRG)
          IF(I.EQ.1)R=R+RMN
      C  NEXT:  WIRE MONOPOLE TO WIRE MONOPOLE.
          CALL ZSMM(-TK,DKW,.ODO,DKW,R,CDKMP,SDKMP,SDK,1.,PMM)
          R=AK*SPH
          IF(I.EQ.1)R=R+RMN
          T1=AK*(1.-CPH)
          T2=T1+DKD
      C  NEXT:  WIRE MONOPOLE TO DISK MONOPOLE.
          CALL ZSMM(-TK,DKW,T1,T2,R,CDKMP,SDKMP,SDKD,.ODO,PMD)
          S1=AK*(1.-CPH)
          S2=S1+DKD
      C  NEXT:  DISK MONOPOLE TO WIRE MONOPOLE.
          CALL ZSMM(S1,S2,TK,TK+DKW,R,CDKD,SDKD,SDK,.ODO,PDM)
      38  FMM=FMM+WF*PMM
          FMD=FMD+WF*PMD
          FDM=FDM+WF*PDM

```

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```

      PHD=57.29578*PH
      IF(IWZ.GT.0)WRITE(8,1)PHD,PMM,PMD,PDM
      SGI=-SGI
40    PH=PH+DPH
      ZMM=ZMM+DPH*FMM/P3
      ZMD=ZMD+DPH*FMD/P3
      ZDM=ZDM+DPH*FDM/P3
      RMN=.ODO
      DPH=(PI-PHA)/LPH
44    PH=PHA
      IF(IWZ.GT.0)WRITE(8,5)
      IF(IWZ.GT.0)WRITE(8,7)
      PHA=.0174533*2.
      PHB=.0174533*20.
      NPH=2*(NPH/2)
      NPHP=NPH+1
      DPH=PHA/NPH
      PH=.ODO
      ZDD=(.ODO,.ODO)
      S2=AK+DKD
      DO 60 IPH=1,3
      ZD=(.ODO,.ODO)
      SGI=-1.
      DO 50 I=1,NPHP
      WF=3.+SGI
      IF(I.EQ.1)WF=1.
      IF(I.EQ.NPHP)WF=1.
      CPH=DCOS(PH)
      IF(I.EQ.1.AND. IPH.GT.1)GO TO 48
C  NEXT:  DISK MONOPOLE TO DISK MONOPOLE.
      CALL ZSMM(AK,S2,AK,S2,TK,CDKD,SDKD,SDKD,CPH,P11)
48    PHD=57.29578*PH
      IF(IWZ.GT.0)WRITE(8,2)PHD,P11
      SGI=-SGI
      PH=PH+DPH
50    ZD=ZD+WF*P11
      ZDD=ZDD+DPH*ZD/P3
      PH=PHA
      DPH=(PHB-PHA)/NPH
      IF(IPH.EQ.1)GO TO 60
      PH=PHB
      DPH=(PI-PHB)/NPH
60    CONTINUE
      Z11=ZDD-ZDM-ZMD+ZMM
      IF(IWZ.GT.0)WRITE(8,5)
      RETURN
      END

```

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```

C*****
C      SUBROUTINE SKEWS
C*****
      SUBROUTINE SKEWS(S1, S3, T1, T3, RHK, CDK, SDK, CDKT, SDKT, CPSI, Z12)
      IMPLICIT REAL*8 (A-H), (P-Z)
      COMPLEX*16 Z12, EIN, EGDZ, CGX, EJXX, EM, EP
      DIMENSION S(3), T(3)
      DOUBLE PRECISION R, SI, SIS, TJ, TJS, XXD, S, T, CI, CJ, FK, FL, DZ
      DOUBLE PRECISION RHS, DZS, DDZ, RIJ, DPSI, CPSS, SPSI, RH2
      DATA ETA, PI, TP/376.730366239, 3.14159265359, 6.28318530718/
      S(1)=S1
      S(2)=(S1+S3)/2.
      S(3)=S3
      T(1)=T1
      T(2)=(T1+T3)/2.
      T(3)=T3
      Z12=(.ODO,.ODO)
      DPSI=CPSI
      IF(DABS(CPSI).LT..999999)GO TO 10
      RHS=RHK*RHK
      CPSS=DPSI*DPSI
      IF(CPSS.GT.1.DO)CPSS=1.DO
      SPSI=DSQRT(1.DO-CPSS)
      RH2=SPSI*(T1+T3)/2.
      RHS=RHS+RH2*RH2
      SGN=1.
      IF(CPSI.GT..ODO)GO TO 60
      SGN=-1.
      T(1)=-T3
      T(2)=-T(2)
      T(3)=-T1
10  DO 50 I=1,3
      SI=S(I)
      SIS=SI*SI
      CI=1.
      IF(I.EQ.2)CI=-2.*CDK
      DO 50 J=1,3
      TJ=T(J)
      TJS=TJ*TJ
      R=DSQRT(SIS+TJS-2.*SI*TJ*DPSI)
      CJ=1.
      IF(J.EQ.2)CJ=-2.*CDKT
      CGX=(.ODO,.ODO)
      DO 40 K=1,2
      FK=(-1.)*K
      DO 40 L=1,2
      FL=(-1.)*L
      XXD=FK*SI+FL*TJ
      XX=XXD
      EJXX=DCMPLX(DCOS(XX),DSIN(XX))
      XXX=R+XXD
      X=DABS(XXX)
      CALL CISI(COSI,CIN,SINI,X)
      IF(XXX.LT..ODO)SINI=-SINI
      CGX=CGX+DCMPLX(COSI,-SINI)*EJXX*FK*FL
40  CONTINUE
      Z12=Z12+CGX*CI*CJ
50  CONTINUE
      Z12=-ETA*Z12/(8.*PI*SDK*SDKT)
      RETURN

```



```

60  DO 80 I=1,3
    SI=S(I)
    CI=1.
    IF (I.EQ.2) CI=-2.*CDK
    CGX=(.ODO,.ODO)
    DO 70 J=1,3
    TJ=T(J)
    CJ=1.
    IF (J.EQ.2) CJ=-2.*CDKT
    DZ=TJ-SI
    R=DSQRT(RHS+DZ*DZ)
    X=R+DZ
    IF (DZ.LT..ODO) X=RHS/(R-DZ)
    CALL CISI(COSI,CIN,SINI,X)
    EP=DCMPLX(COSI,-SINI)
    X=R-DZ
    IF (DZ.GT..ODO) X=RHS/(R+DZ)
    CALL CISI(COSI,CIN,SINI,X)
    EM=DCMPLX(COSI,-SINI)
    EGDZ=DCMPLX(DCOS(DZ),DSIN(DZ))
70  CGX=CGX+CJ*(EP*EGDZ+EM/EGDZ)
80  Z12=Z12+CI*CGX
    Z12=SGN*ETA*Z12/(8.*PI*SDK*SDKT)
    RETURN
    END

```

```

C*****
C      SUBROUTINE SKEWT
C*****
      SUBROUTINE SKEWT(AK, S1, S3, T1, T3, CDK, SDK, CDKD, SDKD, IWZ, Z12)
      IMPLICIT REAL*8 (A-H), (P-Z)
      COMPLEX*16 P12, Z12, Q12
      DATA PI, P3/3.14159265359, 9.42477796077/
      2  FORMAT(1X, BF10.2)
      5  FORMAT(1H0)
      6  FORMAT(5X, 'PRINTOUT FROM SKEWT')
      7  FORMAT(5X, 'WIRE DIPOLE TO DISK DIPOLE')
      IF(IWZ.LE.0)GO TO 20
      WRITE(8,6)
      WRITE(8,7)
      WRITE(8,5)
      20  RMN=AK/100.
          NPH=6
          NPH=2*(NPH/2)
          NPP=NPH+1
          PHA=.0174533*20.
          DPH=PHA/NPH
          Z12=(.0D0,.0D0)
          PH=.0D0
C  WIRE DIPOLE TO DISK DIPOLE.
      DO 80 IPH=1,2
      Q12=(.0D0,.0D0)
      SGI=-1.
      DO 60 I=1,NPP
      WF=3.+SGI
      IF(I.EQ.1)WF=1.
      IF(I.EQ.NPP)WF=1.
      RH=AK*DSIN(PH)
      IF(I.EQ.1)RH=RH+RMN
      AC=AK*DCOS(PH)
      V1=T1-AC
      V3=T3-AC
      IF(I.EQ.1 .AND. IPH.EQ.2)GO TO 50
      CALL SKEW (S1, S3, V1, V3, RH, CDK, SDK, CDKD, SDKD, .0D0, P12)
      50  Q12=Q12+WF*P12
          PHD=57.29578*PH
          IF(IWZ.GT.0D0)WRITE(8,2)PHD, P12
          SGI=-SGI
      60  PH=PH+DPH
          Z12=Z12+DPH*Q12/P3
          RMN=.0D0
          DPH=(PI-PHA)/NPH
      80  PH=PHA
          IF(IWZ.GT.0D0)WRITE(8,5)
          RETURN
      END

```

```

C*****
C      SUBROUTINE SPART
C*****
      SUBROUTINE SPART(AK,DKD,DKW,MAX,IWZ,Z,Z1)
      IMPLICIT REAL*8 (A-H), (P-Z)
      COMPLEX*16 EID(20),EM(20),EP(20),Z(1),Z1(1)
      COMPLEX*16 CEM,CEP,EMD,EPD,EMD2,EPD2,Z11,Z22,Q11,Q11
      DIMENSION CID(20),SID(20),CM(20),CP(20),SM(20),SP(20)
      DOUBLE PRECISION DRQ
      DATA GAM,P2/.577215664,1.57079632/
      DATA ETA,PI/376.727,3.14159/
      IDM=20
1      FORMAT(3X,'MUST INCREASE DIMENSIONS IN SUBROUTINE SPART')
2      FORMAT(3X,'ACTUAL DIMENSION IDM = ',I5,6X,
2'REQUIRED DIMENSION MAX2 = ',I5)
3      FORMAT(1X,BF10.2)
5      FORMAT(1H0)
6      FORMAT(5X,'PRINTOUT FROM SPART')
7      FORMAT(5X,'FIRST: WIRE DIPOLE TO MODE ONE')
8      FORMAT(5X,'THEN: WIRE DIPOLE TO WIRE DIPOLE')
      IF(MAX.LE.0)RETURN
      MAX2=MAX+2
      DO 14 I=1,MAX
      Z1(I)=(.0D0,.0D0)
14     Z(I)=(.0D0,.0D0)
      IF(MAX2.LE.IDM)GO TO 16
      WRITE(9,1)
      WRITE(9,2)IDM,MAX2
      RETURN
16     DK=DKW
      IF(IWZ.LE.0)GO TO 18
      WRITE(8,6)
      WRITE(8,7)
      WRITE(8,8)
      WRITE(8,5)
18     TDK=2.*DK
      SDKD=DSIN(DKD)
      S11=.0D0
      S13=TDK
      S21=DK
      S23=3.*DK
      DO 20 N=1,MAX2
      I=N-1
      DZ=I*DK
      CID(N)=DCOS(DZ)
      SID(N)=DSIN(DZ)
20     EID(N)=DCMPLX(CID(N),SID(N))
      CDK=DCOS(DK)
      SDK=DSIN(DK)
      EPD=DCMPLX(CDK,SDK)
      EMD=DCMPLX(CDK,-SDK)
      EPD2=EPD*EPD
      EMD2=EMD*EMD
      CEM=2.*CDK+EMD
      CEP=2.*CDK+EPD
      AK2=AK*AK
      CSS=ETA/(8.*PI*SDK*SDK)
      NPH=6
      NPH=2*(NPH/2)
      NPP=NPH+1
      PHA=.0174533*20.

```

```

DPH=PHA/NPH
PH=.ODO
DO 100 JPH=1,2
CST=DPH*ETA/(24.*PI*PI*SDK*SDK)
C22=DPH/(3.*PI)
SGN=-1.
DO 80 IPH=1,NPP
CPH=DCOS(PH)
SPH=DSIN(PH)
IF(IPH.GT.1)GO TO 30
IF(JPH.GT.1)GO TO 30
PHO=DPH/10.
CPH=DCOS(PHO)
SPH=DSIN(PHO)
30 T1=AK*(1.-CPH)
T2=T1+DKD
RH=AK*SPH
DRG=2.*AK2*(1.-CPH)
RK=DSQRT(DRG)
RS=DRG
WF=3.+SGN
IF(IPH.EQ.1)WF=1.
IF(IPH.EQ.NPP)WF=1.
WST=WF*CST
W22=WF*C22
DO 40 N=1,MAX2
I=N-1
DZ=I*DK
DZS=DZ*DZ
R=DSQRT(RS+DZS)
ARG=R+DZ
IF(N.EQ.1)ARG=RK
CALL CISI(CP(N),CIN,SP(N),ARG)
EP(N)=DCMLPX(CP(N),-SP(N))
IF(N.GT.1)GO TO 38
CM(1)=CP(1)
SM(1)=SP(1)
EM(1)=EP(1)
GO TO 40
38 ARG=RS/ARG
CALL CISI(CM(N),CIN,SM(N),ARG)
EM(N)=DCMLPX(CM(N),-SM(N))
40 CONTINUE
R=4.*(-CM(2)+2.*CP(1)-CP(2))
A+2.*CID(3)*(+CM(3)-2.*CM(2)+2.*CP(1)-2.*CP(2)+CP(3))
B+2.*SID(3)*(-SM(3)+2.*SM(2)-2.*SP(2)+SP(3))
X=4.*(SM(2)-2.*SP(1)+SP(2))
C+2.*CID(3)*(-SM(3)+2.*SM(2)-2.*SP(1)+2.*SP(2)-SP(3))
D+2.*SID(3)*(-CM(3)+2.*CM(2)-2.*CP(2)+CP(3))
G11=CSS*DCMLPX(R,X)
Z(1)=Z(1)+WST*DCMLPX(R,X)
Z11=-6.*CDK*EP(1)+2.*(EPD+CDK)*EP(2)-EPD*EP(3)+
22.*(EMD+CDK)*EM(2)-EMD*EM(3)
CALL ZSDM(S11,S13,T1,T2,RH,CDK,SDK,SDKD,.ODO,Z22)
G11=CSS*Z11-Z22
Z1(1)=Z1(1)+WST*Z11-W22*Z22
PHD=57.29578*PH
IF(IWZ.GT.0)WRITE(8,3)PHD,G11,G11
IF(MAX.EQ.1)GO TO 70
R=2.*CID(2)*(-CM(3)+3.*CM(2)-4.*CP(1)+3.*CP(2)-CP(3))
E+2.*SID(2)*(+SM(3)-2.*SM(2)+2.*SP(2)-SP(3))

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F+CID(4)*(+CM(4)-2.*CM(3)+CM(2)+CP(2)-2.*CP(3)+CP(4))
G+SID(4)*(-SM(4)+2.*SM(3)-SM(2)+SP(2)-2.*SP(3)+SP(4))
X=2.*CID(2)*(SM(3)-3.*SM(2)+4.*SP(1)-3.*SP(2)+SP(3))
H+2.*SID(2)*(CM(3)-2.*CM(2)+2.*CP(2)-CP(3))
I+CID(4)*(-SM(4)+2.*SM(3)-SM(2)-SP(2)+2.*SP(3)-SP(4))
J+SID(4)*(-CM(4)+2.*CM(3)-CM(2)+CP(2)-2.*CP(3)+CP(4))
Z(2)=Z(2)+WST*DCMLX(R,X)
Z11=2.*EP(1)+CEM*(EMD*EM(3)-EPD*EP(2))+
2CEP*(EPD*EP(3)-EMD*EM(2))-EPD2*EP(4)-EMD2*EM(4)
CALL ZSDM(S21,S23,T1,T2,RH,CDK,SDK,SDKD,.ODO,Z22)
Z1(2)=Z1(2)+WST*Z11-W22*Z22
IF(MAX.EQ.2)GO TO 70
S1=DK
DO 60 N=3,MAX
M1=N-1
M2=N-2
N1=N+1
N2=N+2
Z11=EP(M1)*EID(M1)+EM(M1)/EID(M1)+CEP*(EP(N1)*EID(N)-EM(N)/EID(N))
2-CEM*(EP(N)*EID(N)-EM(N1)/EID(N))-EP(N2)*EID(N1)-EM(N2)/EID(N1)
S1=S1+DK
S3=S1+TDK
CALL ZSDM(S1,S3,T1,T2,RH,CDK,SDK,SDKD,.ODO,Z22)
Z1(N)=Z1(N)+WST*Z11-W22*Z22
CPA=CP(M2)-2.*CP(M1)+CP(N)
CPB=2.*CP(N)-CP(M1)-CP(N1)
CPC=CP(N2)-2.*CP(N1)+CP(N)
CMA=CM(M2)-2.*CM(M1)+CM(N)
CMB=2.*CM(N)-CM(N1)-CM(M1)
CMC=CM(N2)-2.*CM(N1)+CM(N)
SPA=SP(M2)-2.*SP(M1)+SP(N)
SPB=2.*SP(N)-SP(M1)-SP(N1)
SPC=SP(N2)-2.*SP(N1)+SP(N)
SMA=SM(M2)-2.*SM(M1)+SM(N)
SMB=2.*SM(N)-SM(N1)-SM(M1)
SMC=SM(N2)-2.*SM(N1)+SM(N)
R=CID(M2)*(CPA+CMA)+2.*CID(N)*(CPB+CMB)+2.*SID(N)*(SPB-SMB)
K+CID(N2)*(CPC+CMC)+SID(N2)*(SPC-SMC)
IF(N.GT.3)R=R+SID(M2)*(SPA-SMA)
X=-CID(M2)*(SPA+SMA)-2.*CID(N)*(SPB+SMB)+2.*SID(N)*(CPB-CMB)
L-CID(N2)*(SPC+SMC)+SID(N2)*(CPC-CMC)
IF(N.GT.3)X=X+SID(M2)*(CPA-CMA)
60 Z(N)=Z(N)+WST*DCMLX(R,X)
70 PH=PH+DPH
80 SGN=-SGN
DPH=(PI-PHA)/NPH
100 PH=PHA
IF(IWZ.GT.0)WRITE(8,5)
RETURN
END

```

```

C*****
C      SUBROUTINE ZSDM
C*****
      SUBROUTINE ZSDM(S1, S3, T1, T2, RHK, CDK, SDK, SDKT, CPSI, Z12)
      IMPLICIT REAL*8 (A-H), (P-Z)
      COMPLEX*16 E(2,2), F(2,2), ES2, ET2, EXPA, EXPB, EGZI, ES1
      COMPLEX*16 CGX, EJXX, Z12, EP1, EM1, P11, P21, EGDZ, EM, EP
      DIMENSION S(3)
      DOUBLE PRECISION TD1, TD2, SDI, ST1, ST2, R1, R2, SK, ZD, TL1, TL2, SA, SB
      DOUBLE PRECISION R, SI, SIS, TJ, TJS, XXD, S, T, CI, CJ, FK, FL
      DOUBLE PRECISION RHS, DZS, DDZ, RIJ, DPSI, CPSS, SPSI, RH2
      DATA ETA, PI, TP/376.730366239, 3.14159265359, 6.28318530718/
      S(1)=S1
      S2=(S1+S3)/2.
      S(2)=S2
      S(3)=S3
      Z12=(.ODO, .ODO)
      DPSI=CPSI
      CPSS=DPSI*DPSI
      IF(CPSS.GT.1.DO)CPSS=1.DO
      SPSI=DSQRT(1.DO-CPSS)
      IF(DABS(CPSI).LT..999999)GO TO 10
      RHS=RHK*RHK
      RH2=SPSI*(T1+T2)/2.
      RHS=RHS+RH2*RH2
      SGN=1.
      IF(CPSI.GT..ODO)GO TO 80
      S(1)=-S3
      S(2)=-S2
      S(3)=-S1
      SGN=-1.
      GO TO 80
10  D=RHK
      DSQ=D*D
      CD=D/SPSI
      BD=CD*DPSI
      EB=DEXP(-BD)
      EC=DEXP(-CD)
      TD1=T1
      TD2=T2
      TS1=TD1*TD1
      TS2=TD2*TD2
      CST=-ETA/(16.*PI*SDK*SDKT)
      SA=S1
      SB=S2
      ET2=DCMLPX(DCOS(T2), DSIN(T2))
      DO 60 ISS=1,2
      IF(ISS.EQ.1)ES1=DCMLPX(DCOS(SA), DSIN(SA))
      IF(ISS.EQ.2)ES2=DCMLPX(DCOS(SB), DSIN(SB))
      DO 20 K=1,2
      DO 20 L=1,2
20  E(K,L)=(.ODO, .ODO)
      SI=SA
      DO 50 I=1,2
      FI=(-1)**I
      SDI=SI
      SIS=SDI*SDI
      ST1=2.*SDI*TD1*DPSI
      ST2=2.*SDI*TD2*DPSI
      R1=DSQRT(DSQ+SIS+TS1-ST1)
      R2=DSQRT(DSQ+SIS+TS2-ST2)

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      EK=EB
      DO 40 K=1,2
      FK=(-1)**K
      SK=FK*SDI
      EL=EC
      DO 30 L=1,2
      FL=(-1)**L
      EKL=EK*EL
      XX=FK*BD+FL*CD
      TL1=FL*TD1
      TL2=FL*TD2
      RR1=R1+SK+TL1
      RR2=R2+SK+TL2
      CALL EXPJ(DCMPLX(XX,RR1),DCMPLX(XX,RR2),EXPA)
      CALL EXPJ(DCMPLX(-XX,RR1),DCMPLX(-XX,RR2),EXPB)
      E(K,L)=E(K,L)+FI*(EXPA*EKL+EXPB/EKL)
30    EL=1./EC
40    EK=1./EB
      IF(I.EQ.ISS)GO TO 50
      ZD=SDI*DPSI
      ZC=ZD
      EGZI=DCMPLX(DCOS(ZC),DSIN(ZC))
      RR1=R1+ZD-TD1
      RR2=R2+ZD-TD2
      CALL EXPJ(DCMPLX(.ODO,RR1),DCMPLX(.ODO,RR2),EXPB)
      RR1=R1-ZD+TD1
      RR2=R2-ZD+TD2
      CALL EXPJ(DCMPLX(.ODO,RR1),DCMPLX(.ODO,RR2),EXPA)
      F(I,1)=(.ODO,2.)*SDK*EXPA/EGZI
      F(I,2)=(.ODO,2.)*SDK*EXPB/EGZI
50    SI=S3
      IF(ISS.EQ.1)
      AP21=CST*((-F(2,1)-E(2,2)*ES1+E(1,2)/ES1)*ET2
      B+( F(2,2)+E(2,1)*ES1-E(1,1)/ES1)/ET2)
      IF(ISS.EQ.2)
      CP11=CST*(( F(1,1)+E(2,2)*ES2-E(1,2)/ES2)*ET2
      D+(-F(1,2)-E(2,1)*ES2+E(1,1)/ES2)/ET2)
      SA=S2
60    SB=S3
      Z12=P11+P21
      RETURN
80    DO 100 I=1,3
      CI=1.
      IF(I.EQ.2)CI=-2.*CDK
      SI=S(I)
      TJ=T1
      DO 90 J=1,2
      DZ=TJ-SI
      R=DSQRT(RHS+DZ*DZ)
      X=R+DZ
      IF(DZ.LT..ODO)X=RHS/(R-DZ)
      CALL CISI(COSI,CIN,SINI,X)
      EP=DCMPLX(COSI,-SINI)
      X=R-DZ
      IF(DZ.GT..ODO)X=RHS/(R+DZ)
      CALL CISI(COSI,CIN,SINI,X)
      EM=DCMPLX(COSI,-SINI)
      IF(J.EQ.2)GO TO 90
      EP1=EP
      EM1=EM
90    TJ=T2

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```
X=T2-SI
EGDZ=DCMPLX(DCOS(X),DSIN(X))
Z12=Z12+CI*((EP-EP1)*EGDZ+(EM-EM1)/EGDZ)
100 CONTINUE
Z12=SGN*ETA*Z12/(8.*PI*SDK*SDKT)
RETURN
END
```



```

C*****
C      SUBROUTINE ZSMM
C*****
      SUBROUTINE ZSMM(S1, S2, T1, T2, D, CDS, SDS, SDT, CPSI, P11)
      IMPLICIT REAL*8 (A-H), (P-Z)
      DOUBLE PRECISION BD, CD, DD, DO, DZ, DPQ, DSG, DPSI, CPSS
      DOUBLE PRECISION R, R1, R2, SDI, SIS, SK, SPSI, ST1, ST2
      DOUBLE PRECISION TJ, TD1, TD2, TL1, TL2, TS1, TS2, ZD
      COMPLEX*16 E(2,2), F(2,2), GAM, P11, P12, P21, P22
      COMPLEX*16 EQZI, ES1, ES2, ET1, ET2, EXPA, EXPB
      COMPLEX*16 EGDZ, EM, EP, EM1, EP1
      DATA ETA, GAM, PI/376.730366239, (.ODO, 1.), 3.14159265359/
      DD=D
      DPQ=DD*DD
      DPSI=CPSI
      CPSS=DPSI*DPSI
      IF(CPSS.GT.1.DO)CPSS=1.DO
      SPSI=DSQRT(1.DO-CPSS)
      SGDS=SDS
      IF(S2.LT.S1)SGDS=-SDS
      SGDT=SDT
      IF(T2.LT.T1)SGDT=-SDT
      IF(DABS(CPSI).LT.999999)GO TO 6
      DO=SPSI*(T1+T2)/2.
      DSG=DPQ+DO*DO
      GO TO 110
6      ES1=DCMLPX(DCOS(S1),DSIN(S1))
      ES2=DCMLPX(DCOS(S2),DSIN(S2))
      ET1=DCMLPX(DCOS(T1),DSIN(T1))
      ET2=DCMLPX(DCOS(T2),DSIN(T2))
      ID=1
      IF(D.EQ.ODO)ID=0
      TD1=T1
      TD2=T2
      CD=DD/SPSI
      C=CD
      BD=CD*DPSI
      B=BD
      EB=.ODO
      EC=.ODO
      IF(ID.EQ.0)GO TO 8
      EB=DEXP(-B)
      EC=DEXP(-C)
8      DO 10 K=1,2
      DO 10 L=1,2
10     E(K,L)=(.ODO,.ODO)
      TS1=TD1*TD1
      TS2=TD2*TD2
      SI=S1
      DO 100 I=1,2
      FI=(-1)**I
      SDI=SI
      SIS=SDI*SDI
      ST1=2.*SDI*TD1*DPSI
      ST2=2.*SDI*TD2*DPSI
      R1=DSQRT(DPQ+SIS+TS1-ST1)
      R2=DSQRT(DPQ+SIS+TS2-ST2)
      EK=EB
      DO 50 K=1,2
      FK=(-1)**K
      SK=FK*SDI

```

```

      EL=EC
      DO 40 L=1,2
      FL=(-1)**L
      EKL=EK*EL
      XX=FK*BD+FL*CD
      TL1=FL*TD1
      TL2=FL*TD2
      RR1=R1+SK+TL1
      RR2=R2+SK+TL2
      AXX=DABS(XX)
      IF(AXX.GT.DABS(RR1)/100.)GO TO 28
      IF(AXX.GT.DABS(RR2)/100.)GO TO 28
      IF(AXX.GT..001)GO TO 28
      IF(RR1/RR2.LT..0D0)GO TO 28
      CALL CISI(COS1,CIN,SIN1,RR1)
      CALL CISI(COS2,CIN,SIN2,RR2)
      EXPA=DCMLPX(COS2-COS1,SIN1-SIN2)
      E(K,L)=E(K,L)+FI*EXPA*(EKL+1./EKL)
      GO TO 40
28  CALL EXPJ(DCMLPX(XX,RR1),DCMLPX(XX,RR2),EXPA)
      CALL EXPJ(DCMLPX(-XX,RR1),DCMLPX(-XX,RR2),EXPB)
      E(K,L)=E(K,L)+FI*(EXPA*EKL+EXPB/EKL)
40  EL=1./EC
50  EK=1./EB
      IF(I.EQ.2)GO TO 100
      ZD=SDI*DPSI
      ZC=ZD
      EGZI=DCMLPX(DCOS(ZC),DSIN(ZC))
      RR1=R1+ZD-TD1
      RR2=R2+ZD-TD2
      CALL CISI(COS1,CIN,SIN1,RR1)
      CALL CISI(COS2,CIN,SIN2,RR2)
      EXPB=DCMLPX(COS2-COS1,SIN1-SIN2)
      RR1=R1-ZD+TD1
      RR2=R2-ZD+TD2
      CALL CISI(COS1,CIN,SIN1,RR1)
      CALL CISI(COS2,CIN,SIN2,RR2)
      EXPA=DCMLPX(COS2-COS1,SIN1-SIN2)
      F(1,1)=2.*SGDS*(.0D0,1.)*EXPA/EGZI
      F(1,2)=2.*SGDS*(.0D0,1.)*EXPB/EGZI
100 SI=S2
      CST=-ETA/(16.*PI*SGDS*SGDT)
      P11=CST*(( F(1,1)+E(2,2)*ES2-E(1,2)/ES2)*ET2
      A+(-F(1,2)-E(2,1)*ES2+E(1,1)/ES2)/ET2)
      RETURN
110 IF(CPSI.LT.0.)GO TO 120
      TA=T1
      TB=T2
      GO TO 130
120 TA=-T1
      TB=-T2
      SGDT=-SGDT
130 SI=S1
      CI=-CDS
      P11=(.0D0,.0D0)
      DO 150 I=1,2
      TJ=TA
      DO 140 J=1,2
      DZ=TJ-SI
      R=DSQRT(DSQ+DZ*DZ)
      X=R+DZ

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```
      IF(DZ.LT..ODO)X=DSQ/(R-DZ)
      CALL CISI(COSI,CIN,SINI,X)
      EP=DCMLX(COSI,-SINI)
      X=R-DZ
      IF(DZ.GT..ODO)X=DSQ/(R+DZ)
      CALL CISI(COSI,CIN,SINI,X)
      EM=DCMLX(COSI,-SINI)
      IF(J.EQ.2)GO TO 140
      EP1=EP
      EM1=EM
140  TJ=TB
      X=TB-SI
      EGDZ=DCMLX(DCOS(X),DSIN(X))
      P11=P11+CI*((EP-EP1)*EGDZ+(EM-EM1)/EGDZ)
      CI=1.
150  SI=S2
      P11=ETA*P11/(B.*PI*SQDS*SQDT)
      RETURN
      END
```

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```

C*****
C      SUBROUTINE SKEW
C*****
      SUBROUTINE SKEW (S1, S3, T1, T3, RHK, CDK, SDK, CDKT, SDKT, CPSI, Z12)
      IMPLICIT REAL*8 (A-H), (P-Z)
      COMPLEX*16 Z12, EIN, EGDZ, CGX, EJXX, EM, EP
      COMPLEX*16 E(2,2), F(2,2), ES1, ES2, ET1, ET2, EXPA, EXPB, EGZI
      COMPLEX*16 P11, P12, P21, P22
      DIMENSION S(3), T(3)
      DOUBLE PRECISION R, SI, SIS, TJ, TJS, XXD, S, T, CI, CJ, FK, FL, DZ
      DOUBLE PRECISION RHS, DZS, DDZ, RIJ, DPSI, CPSS, SPSI, RH2
      DOUBLE PRECISION TD1, TD2, SDI, ST1, ST2, R1, R2, SK, ZD, TL1, TL2, SA, SB
      DATA ETA, PI, TP/376.730366239, 3.14159265359, 6.28318530718/
      S(1)=S1
      S2=(S1+S3)/2.
      S(2)=S2
      S(3)=S3
      T(1)=T1
      T2=(T1+T3)/2.
      T(2)=T2
      T(3)=T3
      Z12=(.0D0,.0D0)
      DPSI=CPSI
      CPSS=DPSI*DPSI
      IF(CPSS.GT.1.D0)CPSS=1.D0
      SPSI=DSQRT(1.D0-CPSS)
      IF(DABS(CPSI).LT..999999)GO TO 10
      RHS=RHK*RHK
      RH2=SPSI*(T1+T3)/2.
      RHS=RHS+RH2*RH2
      SGN=1.
      IF(CPSI.GT..0D0)GO TO 80
      SGN=-1.
      T(1)=-T3
      T(2)=-T2
      T(3)=-T1
      GO TO 80
10  D=RHK
      DSQ=D*D
      CD=D/SPSI
      BD=CD*DPSI
      EB=DEXP(-BD)
      EC=DEXP(-CD)
      CST=-ETA/(16.*PI*SDK*SDKT)
      TA=T1
      TB=T2
      DO 70 ITT=1,2
      IF(ITT.EQ.1)ET1=DCMPLX(DCOS(TA),DSIN(TA))
      IF(ITT.EQ.2)ET2=DCMPLX(DCOS(TB),DSIN(TB))
      TD1=TA
      TD2=TB
      TS1=TD1*TD1
      TS2=TD2*TD2
      SA=S1
      SB=S2
      DO 60 ISS=1,2
      IF(ISS.EQ.1)ES1=DCMPLX(DCOS(SA),DSIN(SA))
      IF(ISS.EQ.2)ES2=DCMPLX(DCOS(SB),DSIN(SB))
      DO 20 K=1,2
      DO 20 L=1,2
20  E(K,L)=(.0D0,.0D0)

```



```

SI=SA
DO 50 I=1, 2
FI=(-1)**I
SDI=SI
SIS=SDI*SDI
ST1=2. *SDI*TD1*DPSI
ST2=2. *SDI*TD2*DPSI
R1=DSQRT(DSQ+SIS+TS1-ST1)
R2=DSQRT(DSQ+SIS+TS2-ST2)
EK=EB
DO 40 K=1, 2
FK=(-1)**K
SK=FK*SDI
EL=EC
DO 30 L=1, 2
FL=(-1)**L
EKL=EK*EL
XX=FK*BD+FL*CD
TL1=FL*TD1
TL2=FL*TD2
RR1=R1+SK+TL1
RR2=R2+SK+TL2
CALL EXPJ(DCMPLX(XX, RR1), DCMPLX(XX, RR2), EXPA)
CALL EXPJ(DCMPLX(-XX, RR1), DCMPLX(-XX, RR2), EXPB)
E(K, L)=E(K, L)+FI*(EXPA*EKL+EXPB/EKL)
30 EL=1. /EC
40 EK=1. /EB
IF(I. EQ. ISS)GO TO 50
ZD=SDI*DPSI
ZC=ZD
EGZI=DCMPLX(DCOS(ZC), DSIN(ZC))
RR1=R1+ZD-TD1
RR2=R2+ZD-TD2
CALL EXPJ(DCMPLX(. ODO, RR1), DCMPLX(. ODO, RR2), EXPB)
RR1=R1-ZD+TD1
RR2=R2-ZD+TD2
CALL EXPJ(DCMPLX(. ODO, RR1), DCMPLX(. ODO, RR2), EXPA)
F(I, 1)=(. ODO, 2. )*SDK*EXPA/EGZI
F(I, 2)=(. ODO, 2. )*SDK*EXPB/EGZI
50 SI=SB
IF(ITT. EQ. 2)GO TO 54
IF(ISS. EQ. 1)P22=CST*((F(2, 1)+E(2, 2)*ES1-E(1, 2)/ES1)*ET1
A+(-F(2, 2)-E(2, 1)*ES1+E(1, 1)/ES1)/ET1)
IF(ISS. EQ. 2)P12=CST*((-F(1, 1)-E(2, 2)*ES2+E(1, 2)/ES2)*ET1
B+(-F(1, 2)+E(2, 1)*ES2-E(1, 1)/ES2)/ET1)
GO TO 58
54 IF(ISS. EQ. 1)P21=CST*((-F(2, 1)-E(2, 2)*ES1+E(1, 2)/ES1)*ET2
C+(-F(2, 2)+E(2, 1)*ES1-E(1, 1)/ES1)/ET2)
IF(ISS. EQ. 2)P11=CST*((F(1, 1)+E(2, 2)*ES2-E(1, 2)/ES2)*ET2
D+(-F(1, 2)-E(2, 1)*ES2+E(1, 1)/ES2)/ET2)
58 SA=S2
60 SB=S3
TA=T2
70 TB=T3
Z12=P11+P12+P21+P22
RETURN
80 DO 100 I=1, 3
SI=S(I)
CI=1.
IF(I. EQ. 2)CI=-2. *CDK
CGX=(. ODO, . ODO)

```

```

DO 90 J=1,3
TJ=T(J)
CJ=1.
IF (J.EQ.2) CJ=-2.*CDKT
DZ=TJ-SI
R=DSQRT(RHS+DZ*DZ)
X=R+DZ
IF (DZ.LT..ODO) X=RHS/(R-DZ)
CALL CISI(COSI,CIN,SINI,X)
EP=DCMPLX(COSI,-SINI)
X=R-DZ
IF (DZ.GT..ODO) X=RHS/(R+DZ)
CALL CISI(COSI,CIN,SINI,X)
EM=DCMPLX(COSI,-SINI)
EGDZ=DCMPLX(DCOS(DZ),DSIN(DZ))
90  CGX=CGX+CJ*(EP*EGDZ+EM/EGDZ)
100 Z12=Z12+CI*CGX
Z12=SGN*ETA*Z12/(8.*PI*SDK*SDKT)
RETURN
END

```

```

C
C      PROGRAM "RICHMD2"
C      *****
C      *      THIS COMPUTER PROGRAM, IN FORTRAN LANGUAGE, UTILIZES *
C      *      THE CURRENT DISTRIBUTIONS DETERMINED FROM THE "RICHMD1" *
C      *      PROGRAM TO OBTAIN THE RADIATION PATTERN OF A MONOPOLE *
C      *      ELEMENT OF LENGTH h AND RADIUS b AT THE CENTER OF A *
C      *      CIRCULAR GROUNDPLANE OF RADIUS a. AN INPUT FILE, *
C      *      INPUT1.DAT, IS AUTOMATICALLY GENERATED FROM THE *
C      *      "RICHMD1" PROGRAM. *
C      *
C      *      THIS PROGRAM REQUIRES THE USE OF THE MMBSJO *
C      *      SUBROUTINE FUNCTION OF THE IMSL SOFTWARE LIBRARY. MMBSJ1 *
C      *      IS THE MODIFIED BESSEL FUNCTION OF THE FIRST KIND AND *
C      *      ORDER ZERO. *
C      *****
C      IMPLICIT REAL*8 (A-H), (P-Z)
C      INTEGER*4 X, IER
C      REAL*8 THETAD(89), THETA(89), PLOT(89), L
C      REAL*8 BRKT(89), MBRKT(89), DIREC(89), DIRECD(89), DIRECR(89)
C      REAL MMBSJO
C      COMPLEX*16 C(50), E(50), ACUR1, ACUR2
C      COMPLEX*16 ACUR(300), UX, UY, U, USUM
C      COMPLEX*16 SX, SY, S, SSUM
C      COMPLEX*16 GP, GSUM, TSUM
C      OPEN(UNIT=5, STATUS='OLD', FILE='INPUT1.DAT', READONLY)
C      OPEN(UNIT=6, STATUS='NEW', FILE='TEMP')
C      *****
C      READ AND WRITE STATEMENTS *
C      *****
      READ(5, 8) AL, H, EPSLN, NSD, NSW, N, X
      8      FORMAT(E12.4, 2X, F8.6, 2X, F7.4, 2X, 4(I2, 2X))
      FLAG=1.0
      GO TO 70
      71      WRITE(6, 74)
      74      FORMAT(/, 1X, 'INPUT GROUNDPLANE CURRENTS, I')
      WRITE(6, 75)
      75      FORMAT(1X, ' RE(I)', 7X, 'IM(I)')
      DO 1 I=1, N-1
      READ(5, 2) C(I)
      2      FORMAT(2E12.4)
      IF (I.EQ.1) THEN
      E(I)=-C(I)
      ELSE
      E(I)=C(I)
      1      CONTINUE
      DO 77 I=1, NSD
      WRITE(6, 76) E(I), I
      76      FORMAT(2E12.4, 2X, 'AT RHO ', I2)
      77      CONTINUE
      WRITE(6, 78)
      78      FORMAT(/, 1X, 'INPUT MONOPOLE CURRENTS, I')
      WRITE(6, 75)
      DO 555 I=N, NSD+1, -1
      C(I)=C(I-1)
      555      CONTINUE
      C(NSD+1)=C(1)
      DO 41 I=NSD+1, N
      MM=I-NSD
      WRITE(6, 42) C(I), MM
      42      FORMAT(2E12.4, 2X, 'AT Z ', I2)

```

```

41  CONTINUE
    PI=3.1415926536D0
    D=H/NSW
    DD=(EPSLN/(2*PI)-AL)/NSD
    E(NSD+1)=DCMLX(0.0,0.0)
C*****
C  COMPUTE THE AVERAGE CURRENT IN EACH ANNULAR ZONE  *
C*****
    DELTA=DD/X
    K=1
    J=1
    P1=AL
    P2=AL+DELTA
10  ACUR1=E(K)*(DCOS(2*PI*(K*DD+AL-P2))-DCOS(2*PI*(K*DD+AL-P1)))
    ACUR2=E(K+1)*(DCOS(2*PI*(P2-(K-1)*DD-AL))-DCOS(2*PI*(P1-(K-1)*DD-AL)))
    ACUR(J)=(ACUR1-ACUR2)/(2*PI*DELTA*DSIN(2*PI*DD))
    J=J+1
    P1=P1+DELTA
    P2=P2+DELTA
    G=(J-1)/(K*X)
    IF(G.EQ.1) K=K+1
    IF(K.LE.NSD) GO TO 10
C*****
C  CONVERT DEGREE INTO RADIAN  *
C*****
    DO 12 II=1,89
    K=II*2
    THETAD(II)=DFLOAT(K)
    THETA(II)=PI*THETAD(II)/180.0D0
12  CONTINUE
C*****
C  COMPUTE WITH RESPECT TO EVERY TWO DEGREE  *
C*****
    DO 30 INDEX=1,89
C*****
C  FIELD DUE TO THE MONOPOLE  *
C*****
    USUM=DCMLX(0.0,0.0)
    NN=1
40  UXR=DSIN(NN*2*PI*D*DCOS(THETA(INDEX)))
    UXIM=DCOS(NN*2*PI*D*DCOS(THETA(INDEX)))
    UX=DCMLX(-UXR,UXIM)
    UYR1=1-DCOS(2*PI*D)*DCOS(2*PI*D*DCOS(THETA(INDEX)))
    UYR2=DCOS(THETA(INDEX))*DSIN(2*PI*D)*DSIN(2*PI*D*DCOS(THETA(INDEX)))
    UYR=UYR1-UYR2
    UYIM1=DCOS(2*PI*D)*DSIN(2*PI*D*DCOS(THETA(INDEX)))
    UYIM2=DCOS(THETA(INDEX))*DSIN(2*PI*D)*DCOS(2*PI*D*DCOS(THETA(INDEX)))
    UYIM=UYIM1-UYIM2
    UY=DCMLX(UYR,UYIM)
    U=UX*UY*C(NN+NSD)
    USUM=USUM+U
    NN=NN+1
    IF(NN.LE.NSW) GO TO 40
    USUM=USUM/DSIN(2*PI*D)
C*****
    SSUM=DCMLX(0.0,0.0)
    MM=2
50  SXR=DSIN(2*PI*D*(MM-2)*DCOS(THETA(INDEX)))
    SXIM=DCOS(2*PI*D*(MM-2)*DCOS(THETA(INDEX)))
    SX=DCMLX(SXR,-SXIM)
    SYR1=DCOS(2*PI*D)*DCOS(2*PI*D*DCOS(THETA(INDEX)))

```



```

        SYR2=DCOS(THETA(INDEX))*DSIN(2*PI*D)*DSIN(2*PI*D*DCOS(THETA(INDEX)))-1
        SYR=SYR1+SYR2
        SYIM1=DCOS(2*PI*D)*DSIN(2*PI*D*DCOS(THETA(INDEX)))
        SYIM2=DCOS(THETA(INDEX))*DSIN(2*PI*D)*DCOS(2*PI*D*DCOS(THETA(INDEX)))
        SYIM=SYIM1-SYIM2
        SY=DCMPLX(SYR,SYIM)
        S=C(NSD+MM)*SY*SX
        SSUM=SSUM+S
        MM=MM+1
        IF(MM.LE.NSW) GO TO 50
        SSUM=SSUM/DSIN(2*PI*D)
C*****
C      FIELD DUE TO THE GROUNDPLANE
C*****
        GSUM=DCMPLX(0.0,0.0)
        M=1
        P1=AL
        P2=AL+DELTA
60      X1=2*PI*P1*DSIN(THETA(INDEX))
        B1=MMBSJO(X1,IER)
        X2=2*PI*P2*DSIN(THETA(INDEX))
        B2=MMBSJO(X2,IER)
        GP=DCOS(THETA(INDEX))*ACUR(M)*(B1-B2)
        GSUM=GSUM+GP
        P1=P1+DELTA
        P2=P2+DELTA
        M=M+1
        IF(M.LE.(NSD*X)) GO TO 60
C*****
C      COMPUTE THE RADIATION RESISTANCE AND DIRECTIVE GAIN
C*****
        TSUM=GSUM+USUM+SSUM
        RP=DREAL(TSUM)
        P=DIMAG(TSUM)
        BRKT(INDEX)=RP*RP+P*P
        MBRKT(INDEX)=BRKT(INDEX)/DSIN(THETA(INDEX))
30      CONTINUE
        DENOM=0.0D0
        DO 3 K=1,89
        DENOM=DENOM+MBRKT(K)
        3      CONTINUE
        DENOM=DENOM*THETA(1)
        DIRMAX=0.0D0
        DO 4 K=1,89
        DIREC(K)=2.0D0*BRKT(K)/((DSIN(THETA(K)))**2.0D0*DENOM)
        DIRECD(K)=10.0D0*DLOG10(DIREC(K))
        IF(DIRMAX.LT.DIRECD(K))DIRMAX=DIRECD(K)
        4      CONTINUE
        DO 15 J=1,89
        DIRECR(J)=DIRECD(J)-DIRMAX
        15      CONTINUE
        RADRES=15.0*DENOM/(CDABS(C(NSD+1)))**2
C*****
C      WRITE STATMENTS
C*****
70      WRITE(6,80) EPSLN
80      FORMAT(1H1,'EPSLN= ',F7.4,'(NORMALIZED GROUNDPLANE RADIUS)')
        WRITE(6,81) H
81      FORMAT(1X,'MONOPOLE LENGTH= ',F8.6,'(WAVELENGTH)')
        WRITE(6,82) AL
82      FORMAT(1X,'MONOPOLE RADIUS= ',E12.4,'(WAVELENGTH)')

```

```

      WRITE(6,83) NSW
83    FORMAT(1X, 'NUMBER OF MONOPOLE SEGMENTS= ', I2)
      WRITE(6,84) NSD
84    FORMAT(1X, 'NUMBER OF DISK SEGMENTS= ', I2)
      FLAG=FLAG+1.0
      IF (FLAG.LE.2) GO TO 71
      WRITE(6,73)X
73    FORMAT(1X, 'NUMBER OF ANNULAR ZONES PER DISK SEGEMENT= ', I2)
      WRITE(6,96) RADRES
96    FORMAT(1X, 'RADIATION RESISTANCE DETERMINED BY PATTERN= ',
1    E12.6, ' OHMS')
      WRITE(6,47)
47    FORMAT(/, 1X, 'ELEVATION', 53X, 'ELEVATION')
      WRITE(6,85)
85    FORMAT(1X, 2('ANGLE', 6X, 'DIRECTIVITY', 5X, 'DIRECTIVITY', 5X
1    , 'RELATIVE POWER', 5X))
      WRITE(6,86)
86    FORMAT(1X, 2('(DEG)', 6X, '(NUMERIC)', 7X, '(dB)', 11X
1    , '(dB)', 15X))
      WRITE(6,87)
87    FORMAT(/, 2X, ' 0. ', 9X, '0.00000', 5X, '-INFINITY', 6X, '-INFINITY')
      DO 16 L=1, 44
      WRITE(6,88) THETAD(L), DIREC(L), DIRECD(L), DIRECR(L)
1    , THETAD(L+45), DIREC(L+45), DIRECD(L+45), DIRECR(L+45)
88    FORMAT(1X, 2(1X, F5.1, 6X, F9.5, 5X, F9.5, 6X, F9.5, 11X))
16    CONTINUE
      WRITE(6,89) THETAD(45), DIREC(45), DIRECD(45), DIRECR(45)
89    FORMAT(1X, 1X, F5.1, 6X, F9.5, 5X, F9.5, 6X, F9.5, 12X, '180. '
1    , 9X, '0.00000', 5X, '-INFINITY', 6X, '-INFINITY')
23    CONTINUE
      CLOSE(UNIT=5, STATUS='KEEP')
      CLOSE(UNIT=6, STATUS='KEEP')
      END

```

APPENDIX B3. LISTING OF PROGRAM "MONOPL"
(Oblate Spheroidal Wave Functions)

MONOPL (1 of 18 pages)

```

C*****
C
C                                PROGRAM  "MONOPL"
C
C*****
C
C  THIS PROGRAM IS WRITTEN IN FORTRAN FOR A DEC PDP 11/70.
C  IT CALCULATES, BY THE METHOD OF OBLATE SPHEROIDAL WAVE FUNCTIONS,
C  THE DIRECTIVITY (D,DBBI) AND THE RADIATION RESISTANCE
C  (RADRES) IN OHMS FOR A QUARTERWAVE MONOPOLE ANTENNA MOUNTED
C  AT THE CENTER OF CIRCULAR GROUNDPLANE OF RADIUS  $a$  IN FREE
C  SPACE, WHERE  $a$  IS OF THE ORDER OF A WAVELENGTH.
C
C*****
C
C  THE INPUT VARIABLE IS:   $\epsilon$  (EPSLN) GIVEN BY
C   $\epsilon = 2\pi a/\lambda$  (NORMALIZED GROUNDPLANE RADIUS)
C  WHERE  $\lambda$  IS THE EXCITATION WAVELENGTH. THIS IS ENTERED IN THE
C  MAIN PROGRAM ON LINE 12.
C
C*****
C
C  THE OUTPUT VARIABLES ARE:
C
C  RADRES -- THE ANTENNA'S RADIATION RESISTANCE (OHMS)
C  D      -- THE ANTENNA'S DIRECTIVITY (NUMERIC)
C  DBBI   -- THE ANTENNA'S DIRECTIVITY (DB)
C  THETA  -- ANGLE FROM THE ZENITH (RADIAN)
C  THETAD -- ANGLE FROM THE ZENITH (DEGREES)
C
C*****
C
C  REFERENCES:
C
C  1)  A. LEITNER AND R.D. SPENCE, "THE OBLATE SPHEROIDAL WAVE
C      FUNCTIONS", JOURNAL OF THE FRANKLIN INSTITUTE,
C      VOL. 249, NUMBER 4, APRIL 1950, PAGES 299-321.
C
C  2)  A. LEITNER AND R.D. SPENCE, "EFFECT OF A CIRCULAR
C      GROUNDPLANE ON ANTENNA RADIATION", JOURNAL OF APPLIED
C      PHYSICS, VOL. 21, OCTOBER 1950, PAGES 1001-1006.
C
C  3)  M.M. WEINER, S.P. CRUZE, C.C. LI, W.J. WILSON, "MONOPOLE
C      ELEMENT AT THE CENTER OF A CIRCULAR GROUNDPLANE OF
C      ARBITRARY RADIUS", MITRE TECHNICAL REPORT MTR-9622,
C      SECTION 3.6, MAY 1985.
C
C*****
C
C  THIS PROGRAM CONSISTS OF THE MAIN ROUTINE AND THE FOLLOWING
C  SUBROUTINES: GAMMA, AALPHA, CEE, ANGLAR, FACTOR, ODDEVN,
C  NORMAL, QUE, FACTR2, BAETA, QU, RAD30, DBLYU2, BEE,
C  DIRECT, AEY, BBEE, GSEE, RAD1, RAD2, RADRES, IMPROV,
C  ODD, EVEN.
C
C*****

```


MONOPL (2 of 18 pages)

```

C
C
C
C
C      ** MAIN ROUTINE **
C
COMPLEX*8 Q1(20,1),B(20),V30(20,1)
REAL*8 U(20,1),NUE,C(40,20,1),V1(20,1),PSI,BETA(20,1)
REAL*8 GAM(20,1),F(8,20,1),ALPHA(20,1),EPSLN,N(20,1)
REAL*8 Q2(20,1),V2(20,1),W(20,1),D,A(40,20,1)
REAL*8 BB(40,20,1),B0(20,1),G(20,1),R,V22(20,1),GAMIMP(20,1)
REAL*8 INCR,THETA,DBBI,THETAD
INDEX=10
JNDEX=24
KNDEX=12
LNDEX=18
MNDEX=18
C
C
C INPUT:
C
C     EPSLN=3.0D0
C
C     WRITE(4,4) EPSLN
C     WRITE(4,5)
C   5 FORMAT(1X,'ANGLE FROM ZENITH(DEGREES)',3X,'ANGLE FROM ZENITH
C     *(RADIAN)',3X,'DIRECTIVITY(DBI)',3X,'DIRECTIVITY(NUMERIC)')
C     INCR=1.0D0
C   2 CONTINUE
C     THETA=INCR*3.1415926536D0/90.0D0
C     THETAD=THETA*180.0D0/3.1415926536D0
C     NUE=DCOS(THETA)
C
C CALL SUBROUTINES
C
CALL GAMMA(F,GAM,EPSLN,INDEX)
CALL IMPROV(GAM,GAMIMP,EPSLN,INDEX)
CALL AALPHA(ALPHA,GAMIMP,INDEX)
CALL CEE(C,GAMIMP,EPSLN,INDEX,JNDEX)
CALL ANGLAR(C,U,NUE,INDEX,KNDEX)
CALL NORMAL(C,N,INDEX,KNDEX)
CALL QUE(Q1,C,EPSLN,INDEX,KNDEX)
CALL BAETA(C,BETA,INDEX,KNDEX)
CALL QU(Q2,BETA,Q1,EPSLN,INDEX)
CALL AEY(A,ALPHA,EPSLN,INDEX,LNDEX)
CALL RAD1(EPSLN,A,V1,INDEX,LNDEX)
CALL BBEE(BB,EPSLN,ALPHA,A,BETA,B0,INDEX,LNDEX,MNDEX)
CALL GGEE(EPSLN,BB,G,B0,INDEX,MNDEX)
CALL RAD2(V2,EPSLN,G,V1,Q2,INDEX)
CALL RAD30(BETA,Q2,V30,INDEX)
CALL DBLYU2(W,EPSLN,V1,V2,Q2,BETA,INDEX)
CALL BEE(B,W,ALPHA,N,Q1,V30,INDEX)
CALL DIRECT(B,U,EPSLN,D,N,INDEX,DBBI)
CALL RADRES(B,N,EPSLN,R,INDEX)
C
C OUTPUT:
C
C     WRITE(4,1) THETAD,THETA,DBBI,D
C
C     IF(INCR.EQ.89.0D0) GOTO 3
C     INCR=INCR+1.0D0
C     GOTO 2
C   6 FORMAT(///1X,'RADIATION RESISTANCE = ',F10.5,1X,'OHMS')
C   4 FORMAT(1X,'EPSILON = ',F5.2//)
C   1 FORMAT(10X,F5.1,24X,F7.5,16X,F9.5,11X,F9.5)
C   3 CONTINUE
C     WRITE(4,6) R
C     STOP
C     END

```

```

C
C
C
C      ** SUBROUTINE GAMMA **
C THIS SUBROUTINE CALCULATES THE RAW EIGENVALUES FROM EQUATION 21,
C REFERENCE 1. THE F'S CORRESPOND TO THE F'S FROM EQUATIONS 22,23,24,AND
C 25. THE H CORRESPONDS TO THE H FROM EQUATION 26.
C THIS SUBROUTINE IS CALLED FROM MAIN AND DOES NOT CALL ANY OTHER
C SUBROUTINES.
C INPUTS: EPSLN,INDEX
C OUTPUT: GAM
C
      SUBROUTINE GAMMA(F,GAM,EPSLN,INDEX)
      REAL*8 F(8,20,1),GAM(20,1),H,A,B,EPSLN,AJ
      REAL*8 Z1,Z2,Z3,Z4,Z5,Z6,Z7,Z8
      H(A)=(A*A-1.0D0)/(4.0D0*A*A-1.0D0)
      DO 4 N=1,INDEX
      CAM(N,1)=0.0D0
4 CONTINUE
      B=1.0D0
      DO 1 L=1,INDEX
      F(2,L,1)=2.0D0*(B*(B+1.0D0))/((2.0D0*B-1.0D0)*(2.0D0*B+3.0D0))
      F(4,L,1)=H(B-1.0D0)*H(B)/(2.0D0*(2.0D0*B-1.0D0))-
      *H(B+1.0D0)*H(B+2.0D0)/(2.0D0*(2.0D0*B+3.0D0))
      F(6,L,1)=(3.0D0/((2.0D0*B-1.0D0)*(2.0D0*B+3.0D0)))*H(B-1.0D0)
      **H(B)/((2.0D0*B-1.0D0)**2.0D0)*(2.0D0*B-5.0D0))-H(B+1.0D0)
      **H(B+2.0D0)/((2.0D0*B+3.0D0)**2.0D0)*(2.0D0*B+7.0D0))
      Z1=H(B-1.0D0)*H(B)/(2.0D0*(2.0D0*B-1.0D0))
      Z2=36.0D0/((2.0D0*B-5.0D0)**2.0D0*(2.0D0*B-1.0D0)**4.0D0
      *(2.0D0*B+3.0D0)**2.0D0)
      Z3=F(4,L,1)/(2.0D0*(2.0D0*B-1.0D0))
      Z4=H(B-3.0D0)*H(B-2.0D0)/(8.0D0*(2.0D0*B-1.0D0)*
      *(2.0D0*B-3.0D0))
      Z5=H(B+1.0D0)*H(B+2.0D0)/(2.0D0*(2.0D0*B+3.0D0))
      Z6=36.0D0/((2.0D0*B-1.0D0)**2.0D0*(2.0D0*B+3.0D0)**4.0D0
      *(2.0D0*B+7.0D0)**2.0D0)
      Z7=F(4,L,1)/(2.0D0*(2.0D0*B+3.0D0))
      Z8=H(B+3.0D0)*H(B+4.0D0)/(8.0D0*(2.0D0*B+3.0D0)*
      *(2.0D0*B+5.0D0))
      F(8,L,1)=Z1*(Z2-Z3+Z4)-Z5*(Z6+Z7+Z8)
      B=B+1.0D0
1 CONTINUE
      DO 2 L=1,INDEX
      AJ=2.0D0
      DO 3 J=2,8,2
      CAM(L,1)=GAM(L,1)+F(J,L,1)*EPSLN**AJ
      AJ=AJ+2.0D0
3 CONTINUE
2 CONTINUE
      RETURN
      END

```

MONOPL (4 of 18 pages)

```

C
C      ** SUBROUTINE AALPHA **
C
C THIS SUBROUTINE CALCULATES ALPHA FROM EQUATION 15, REFERENCE 1.
C GAM IS THE REFINED EIGENVALUE WHICH IS INPUT TO THE SUBROUTINE.
C THIS SUBROUTINE IS CALLED FROM MAIN.
C INPUTS: GAM,INDEX
C OUTPUT: ALPHA
C
      SUBROUTINE AALPHA(ALPHA,GAM,INDEX)
      REAL*8 ALPHA(20,1),GAM(20,1),AL
      AL=1.0D0
      DO 1 L=1,INDEX
      ALPHA(L,1)=AL*(AL+1.0D0)+GAM(L,1)
      AL=AL+1.0D0
1 CONTINUE
      RETURN
      END
C
C      ** SUBROUTINE CEE **
C
C THIS SUBROUTINE CALCULATES THE C'S IN EQUATIONS 16 AND 17 IN
C REFERENCE 1.
C THIS SUBROUTINE IS CALLED FROM MAIN AND DOES NOT CALL ANY OTHER
C SUBROUTINES.
C INPUTS: GAM,EPSLN,INDEX,JNDEX
C OUTPUT: C
C
      SUBROUTINE CEE(C,GAM,EPSLN,INDEX,JNDEX)
      REAL*8 C(40,20,1),GAM(20,1),AL,AJ,EPSLN
      AL=1.0D0
      DO 1 L=1,(INDEX-1),2
      C(2,L,1)=((1.0D0-AL)*(2.0D0+AL)-GAM(L,1))/8.0D0
      C(4,L,1)=(((3.0D0-AL)*(4.0D0+AL)-GAM(L,1))*C(2,L,1)+
      *EPSLN**2.0D0)/24.0D0
      AJ=6.0D0
      DO 2 J=6,JNDEX,2
      C(J,L,1)=(((AJ-1.0D0-AL)*(AJ+AL)-GAM(L,1))*C(J-2,L,1)+
      *C(J-4,L,1)*EPSLN**2.0D0)/(AJ*(AJ+2.0D0))
      AJ=AJ+2.0D0
2 CONTINUE
      AL=AL+2.0D0
1 CONTINUE
      AL=2.0D0
      DO 3 L=2,INDEX,2
      C(2,L,1)=((2.0D0-AL)*(3.0D0+AL)-GAM(L,1))/8.0D0
      C(4,L,1)=(((4.0D0-AL)*(5.0D0+AL)-GAM(L,1))*C(2,L,1)+
      *EPSLN**2.0D0)/24.0D0
      AJ=6.0D0
      DO 4 J=6,JNDEX,2
      C(J,L,1)=(((AJ-AL)*(AJ+1.0D0+AL)-GAM(L,1))*C(J-2,L,1)
      *+C(J-4,L,1)*EPSLN**2.0D0)/(AJ*(AJ+2.0D0))
      AJ=AJ+2.0D0
4 CONTINUE
      AL=AL+2.0D0
3 CONTINUE
      RETURN
      END

```

```

C
C
C      ** SUBROUTINE ANGLAR **
C
C THIS SUBROUTINE CALCULATES THE ANGULAR SPHEROIDAL WAVE FUNCTIONS
C AS PER EQUATION 13 AND 14, REFERENCE 1. THE ANGULAR SPHEROIDAL
C WAVE FUNCTIONS ARE REPRESENTED BY U AND THE COEFFICIENTS BY C.
C THIS SUBROUTINE IS CALLED FROM MAIN AND DOES NOT CALL ANY SUBROUTINES.
C INPUTS: C,NUE,INDEX,KNDEX
C OUTPUT: U
C
      SUBROUTINE ANGLAR(C,U,NUE,INDEX,KNDEX)
      REAL*8 C(40,20,1),U(20,1),NUE,AJ
      DO 3 N=1,INDEX
      U(N,1)=0.0D0
3 CONTINUE
      DO 1 L=1,(INDEX-1),2
      AJ=1.0D0
      DO 2 J=1,KNDEX
      U(L,1)=U(L,1)+C(2*J,L,1)*(1.0D0-NUE**2.0D0)**AJ
      AJ=AJ+1.0D0
2 CONTINUE
      U(L,1)=DSQRT(1.0D0-NUE**2.0D0)*(1.0D0+U(L,1))
1 CONTINUE
      DO 4 L=2,INDEX,2
      AJ=1.0D0
      DO 5 J=1,KNDEX
      U(L,1)=U(L,1)+C(2*J,L,1)*(1.0D0-NUE**2.0D0)**AJ
      AJ=AJ+1.0D0
5 CONTINUE
      U(L,1)=DSQRT(1.0D0-NUE**2.0D0)*NUE*(1.0D0+U(L,1))
4 CONTINUE
      RETURN
      END
C
C
C      ** SUBROUTINE FACTOR **
C
C THIS SUBROUTINE CALCULATES THE FRACTIONAL PART OF EQUATIONS 28 AND
C 29 IN REFERENCE 1.
C THIS SUBROUTINE IS CALLED FROM NORMAL AND DOES NOT CALL ANY
C SUBROUTINES.
C INPUTS: I,J,ITERM,AI,AJ
C OUTPUTS: AF,DENOM,B
C
      SUBROUTINE FACTOR(ITERM,AI,AJ,DENOM,AF,I,J,B)
      REAL*8 AI,AJ,DENOM,AF,AN,B,AM
      AF=1.0D0
      DENOM=1.0D0
      AN=1.0D0
      DO 1 N=1,(1+I+J)
      AF=AF*AN
      AN=AN+1.0D0
1 CONTINUE
      AM=1.0D0
      DO 2 M=1,(2*(I+J+1)+ITERM),2
      DENOM=DENOM*AM
      AM=AM+2.0D0
2 CONTINUE
      B=2.0D0**(2.0D0+AI+AJ)
      RETURN
      END

```



```
C
C      ** SUBROUTINE ODDEVN **
C THIS SUBROUTINE FIGURES OUT WHETHER A ONE OR A THREE BELONGS IN THE
C DENOMINATOR OF EQUATIONS 28 AND 29 OF REFERENCE 1. THE PROGRAM INPUTS
C L, DETERMINES WHETHER L-1 IS ODD OR EVEN AND OUTPUTS THE CORRESPONDING
C 3 OR 1.
C THIS SUBROUTINE IS CALLED FROM NORMAL AND CALLS NO OTHER SUBROUTINES.
C INPUTS: L
C OUTPUTS: ITERM
C
SUBROUTINE ODDEVN(L,ITERM)
  ITERM=1
  B=FLOATI(L)
  I=L/2
  C=B/2.0+0.6
  J=IINT(C)
  IF(J.EQ.I) ITERM=3
  RETURN
END
C
C      ** SUBROUTINE NORMAL **
C THIS SUBROUTINE CALCULATES THE NORMALIZATION FACTOR,N, FOR THE
C ANGULAR FUNCTIONS,U. THIS SUBROUTINE CALCULATES EQUATIONS 28
C AND 29 OF REFERENCE 1.
C THIS SUBROUTINE CALLS SUBROUTINES FACTOR AND ODDEVN, AND IS CALLED
C FROM MAIN.
C INPUTS: C,INDEX,KINDEX
C OUTPUTS: N
C
SUBROUTINE NORMAL(C,N,INDEX,KINDEX)
  REAL*8 N1,AJ,AI,AF,DENOM,B,N2,N(20,1),C(40,20,1)
  DO 4 L=1,INDEX
    CALL ODDEVN(L,ITERM)
    I=C
    AJ=1.0D0
    AI=0.0D0
    N1=0.0D0
    DO 1 J=1,KINDEX
      CALL FACTOR(ITERM,AI,AJ,DENOM,AF,I,J,B)
      N1=N1+C(2*J,L,1)*B*AF/DENOM
      AJ=AJ+1.0D0
1 CONTINUE
      N1=2.0D0*N1
      AI=1.0D0
      N2=0.0D0
      DO 2 I=1,KINDEX
        AJ=1.0D0
        DO 3 J=1,KINDEX
          CALL FACTOR(ITERM,AI,AJ,DENOM,AF,I,J,B)
          N2=N2+C(2*J,L,1)*C(2*I,L,1)*B*AF/DENOM
          AJ=AJ+1.0D0
2 CONTINUE
          AI=AI+1.0D0
2 CONTINUE
          CALL FACTOR(ITERM,O.OO0,O.OO0,DENOM,AF,O,O,B)
          N(L,1)=AF*B/DENOM+N1+N2
4 CONTINUE
  RETURN
END
```

```
C
C                                     ** SUBROUTINE QUE **
C THIS SUBROUTINE CALCULATES THE JOINING FACTOR Q, USING EQUATIONS
C 69 AND 70 IN REFERENCE 1.
C THIS SUBROUTINE CALLS SUBROUTINE FACTR2 AND IS CALLED FROM MAIN.
C INPUTS: C,EPSLN,INDEX,KNDEX
C OUTPUTS: Q1
C
SUBROUTINE QUE(Q1,C,EPSLN,INDEX,KNDEX)
REAL IMPRT
COMPLEX Q1(20,1)
REAL*8 AF,DENOM,B,AK,TERM,C(40,20,1)
DO 1 L=1,(INDEX-1),2
    AK=1.0D0
    TERM=0.0D0
    DO 2 K=1,KNDEX
        CALL FACTR2(AK,K,DENOM,AF,B,1)
        TERM=TERM+C(2*K,L,1)*AF*B/DENOM
        AK=AK+1.0D0
2 CONTINUE
CALL FACTR2(0.0D0,0,DENOM,AF,B,1)
TERM=TERM+B*AF/DENOM
RLPRT=1.0/TERM
Q1(L,1)=CMPLX(RLPRT,0.0)
1 CONTINUE
DO 3 L=2,INDEX,2
    AK=1.0D0
    TERM=0.0D0
    DO 4 K=1,KNDEX
        CALL FACTR2(AK,K,DENOM,AF,B,3)
        TERM=TERM+C(2*K,L,1)*AF*B/DENOM
        AK=AK+1.0D0
4 CONTINUE
CALL FACTR2(0.0D0,0,DENOM,AF,B,3)
TERM=TERM+B*AF/DENOM
IMPRT=-1.0/(EPSLN*TERM)
Q1(L,1)=CMPLX(0.0,IMPRT)
3 CONTINUE
RETURN
END
C
C                                     ** SUBROUTINE FACTR2 **
C THIS SUBROUTINE CALCULATES THE FRACTIONAL PART OF EQUATIONS 69
C AND 70 IN REFERENCE 1.
C THIS SUBROUTINE IS CALLED FROM SUBROUTINE QUE, AND CALLS NO
C OTHER SUBROUTINES.
C INPUTS: AK,K,ITERM
C OUTPUTS: DENOM,AF,B
C
SUBROUTINE FACTR2(AK,K,DENOM,AF,B,ITERM)
REAL*8 AK,DENOM,AF,B,AN
AF=1.0D0
DENOM=1.0D0
AN=1.0D0
DO 1 N=1,(1+K)
    AF=AF*AN
    AN=AN+1.0D0
1 CONTINUE
AM=1.0D0
DO 2 M=1,(2*(K+1)+ITERM),2
    DENOM=DENOM*AM
    AM=AM+2.0D0
2 CONTINUE
B=2.0D0**((1.0D0+AK)
RETURN
END
```

```

C
C
C      ** SUBROUTINE BAETA **
C
C THIS SUBROUTINE CALCULATES AN INTERMEDIATE RESULT BASED ON EQUATIONS
C 44 AND 45 FROM REFERENCE 1. BETA CAN ALSO BE DERIVED FROM EQUATIONS
C 84,87, AND 88 IN REFERENCE 1.
C THIS SUBROUTINE IS CALLED FROM MAIN, AND CALLS NO OTHER SUBROUTINES.
C INPUTS: C,INDEX,KINDEX
C OUTPUT: BETA
C
      SUBROUTINE BAETA(C,BETA,INDEX,KINDEX)
      REAL*8 C(40,20,1),BETA(20,1),TERM
      DO 2 L=1,(INDEX-1),2
      TERM=1.0D0
      DO 1 I=1,KINDEX
      TERM=TERM+C(2*I,L,1)
1  CONTINUE
      TERM=TERM*TERM
      BETA(L,1)=(0.5D0-2.0D0*C(2,L,1))*TERM
2  CONTINUE
      DO 4 L=2,INDEX,2
      TERM=1.0D0
      DO 3 I=1,KINDEX
      TERM=TERM+C(2*I,L,1)
3  CONTINUE
      TERM=TERM*TERM
      BETA(L,1)=(1.5D0-2.0D0*C(2,L,1))*TERM
4  CONTINUE
      RETURN
      END
C
C      ** SUBROUTINE QU **
C
C THIS SUBROUTINE EVALUATES EQUATIONS 87 AND 88 IN REFERENCE 1.
C THIS SUBROUTINE IS CALLED FROM MAIN AND CALLS NO SUBROUTINES.
C INPUTS: BETA,Q1,EPSLN,INDEX
C OUTPUT: Q2
C
      SUBROUTINE QU(Q2,BETA,Q1,EPSLN,INDEX)
      REAL*8 Q2(20,1),BETA(20,1),EPSLN
      COMPLEX Q1(20,1)
      DO 1 L=1,INDEX
      Q2(L,1)=4.0D0*BETA(L,1)*(CABS(Q1(L,1))**2.0)/(EPSLN**3.0D0)
1  CONTINUE
      RETURN
      END
C
C      ** SUBROUTINE RAD30 **
C
C THIS SUBROUTINE CALCULATES THE DERIVATIVE OF THE RADIAL FUNCTION
C OF THE THIRD KIND, EVALUATED AT ZERO. SEE EQUATION 57 REFERENCE 1.
C THIS SUBROUTINE IS CALLED FROM MAIN AND CALLS NO OTHER SUBROUTINES.
C INPUTS: Q2,BETA,INDEX
C OUTPUTS: V30
C
      SUBROUTINE RAD30(BETA,Q2,V30,INDEX)
      REAL*8 BETA(20,1),Q2(20,1)
      COMPLEX V30(20,1)
      DO 1 L=1,(INDEX-1),2
      A=Q2(L,1)/BETA(L,1)
      V30(L,1)=CMPLX(0.0,A)
1  CONTINUE
      DO 2 L=2,INDEX,2
      B=-Q2(L,1)*1.570796327D0
      V30(L,1)=CMPLX(1.0,B)
2  CONTINUE
      RETURN
      END

```

```

C
C
C      ** SUBROUTINE DBLYU2 **
C
C THIS SUBROUTINE EVALUATES EQUATION 26 OF REFERENCE 2, USING THE
C PORTION OF EQUATION 17, REFERENCE 2, WHICH IS IN BRACKETS.
C THIS SUBROUTINE IS CALLED FROM MAIN AND CALLS NO OTHER SUBROUTINE.
C INPUTS: EPSLN,V1,V2,Q2,BETA,INDEX
C OUTPUT: W
C
      SUBROUTINE DBLYU2(W,EPSLN,V1,V2,Q2,BETA,INDEX)
      REAL*8 W(20,1),PSI,V1(20,1),V2(20,1)
      REAL*8 Q2(20,1),BETA(20,1),EPSLN,PI2
      PI2=1.570796327D0
      PSI=PI2/EPSLN
      DO 1 L=1,(INDEX-1),2
      W(L,1)=DSQRT(1.0D0+PSI*PSI)*(Q2(L,1)*V1(L,1)/
      *BETA(L,1))
1 CONTINUE
      DO 2 L=2,INDEX,2
      W(L,1)=DSQRT(1.0D0+PSI*PSI)*(-Q2(L,1)*1.570796327D0
      **V1(L,1)-V2(L,1))
2 CONTINUE
      RETURN
      END
C
C
C      ** SUBROUTINE BEE **
C
C THIS SUBROUTINE CALCULATES THE B'S IN EQUATION 35 OF REFERENCE 2.
C THIS SUBROUTINE IS CALLED FROM MAIN AND CALLS NO SUBROUTINES.
C INPUTS: W,ALPHA,N,Q1,V30,INDEX
C OUTPUT: B
C
      SUBROUTINE BEE(B,W,ALPHA,N,Q1,V30,INDEX)
      COMPLEX Q1(20,1),V30(20,1),B(20)
      REAL*8 W(20,1),ALPHA(20,1),N(20,1)
      DO 1 L=1,(INDEX-1),2
      B(L)=W(L,1)/(ALPHA(L,1)*N(L,1)*Q1(L,1)*V30(L,1))
1 CONTINUE
      DO 2 L=2,INDEX,2
      B(L)=-W(L,1)/(ALPHA(L,1)*N(L,1)*Q1(L,1)*V30(L,1))
2 CONTINUE
      RETURN
      END
C
C
C      ** SUBROUTINE DIRECT **
C
C THIS PROGRAM CALCULATES THE DIRECTIVITY,D, AND THE DIRECTIVITY,
C DDBI, IN DBI, USING EQUATIONS FOR DIRECTIVITY DEVELOPED IN THE
C WORKING PAPER. THESE EQUATIONS, IN TURN, COME FROM EQUATIONS 43 AND
C 45 OF REFERENCE 2.
C THIS SUBROUTINE IS CALLED FROM MAIN AND CALLS NO SUBROUTINES.
C INPUTS: U,EPSLN,N,INDEX,B
C OUTPUTS: D,DDBI
C
      SUBROUTINE DIRECT(B,U,EPSLN,D,N,INDEX,DDBI)
      COMPLEX B(20),SI
      REAL*8 U(20,1),EPSLN,D,S,P,N(20,1),DDBI
      SI=CMPLX(0.0,0.0)
      DO 1 L=1,INDEX
      SI=SI+B(L)*U(L,1)
1 CONTINUE
      S=(CABS(SI))**2.0D0
      P=0.0D0
      DO 2 J=1,INDEX
      P=P+N(J,1)*(CABS(B(J))**2.0)
2 CONTINUE
      D=S/P*2.0D0
      DDBI=10.0D0*DLOG10(D)
      RETURN
      END

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```
C
C      ** SUBROUTINE AEY **
C
C THIS SUBROUTINE EVALUATES THE A'S IN EQUATION 35 REFERENCE 1.
C THIS SUBROUTINE IS CALLED FROM MAIN AND CALLS NO OTHER SUBROUTINES.
C INPUTS: ALPHA,EPSLN,INDEX,LNDEX
C OUTPUT: A
C
  SUBROUTINE AEY(A,ALPHA,EPSLN,INDEX,LNDEX)
    REAL*8 A(40,20,1),ALPHA(20,1),EPSLN,AN
    DO 1 L=1,(INDEX-1),2
      A(2,L,1)=(ALPHA(L,1)-EPSLN*EPSLN-2.0D0)/2.0D0
      A(4,L,1)=((ALPHA(L,1)-EPSLN*EPSLN-12.0D0)*A(2,L,1)
        *-EPSLN*EPSLN)/12.0D0
      AN=6.0D0
      DO 2 N=6,LNDEX,2
        A(N,L,1)=((ALPHA(L,1)-EPSLN*EPSLN-2.0D0-(AN-2.0D0)
          ***(AN+1.0D0))*A(N-2,L,1)-EPSLN*EPSLN*A(N-4,L,1))/
          *(AN*(AN-1.0D0))
        AN=AN+2.0D0
2     CONTINUE
1     CONTINUE
    DO 3 L=2,INDEX,2
      A(1,L,1)=1.0D0
      A(3,L,1)=(ALPHA(L,1)-EPSLN*EPSLN-6.0D0)/6.0D0
      AN=5.0D0
      DO 4 N=5,(LNDEX-1),2
        A(N,L,1)=((ALPHA(L,1)-EPSLN*EPSLN-2.0D0-(AN-2.0D0)
          ***(AN+1.0D0))*A(N-2,L,1)-EPSLN*EPSLN*A(N-4,L,1))/
          *(AN*(AN-1.0D0))
        AN=AN+2.0D0
4     CONTINUE
3     CONTINUE
    RETURN
  END
```

```

C
C
C      ** SUBROUTINE BBEE **
C
C THIS SUBROUTINE EVALUATES THE B'S, HERE CALLED BB, IN EQUATION 50,
C REFERENCE 1.
C THIS SUBROUTINE IS CALLED FROM MAIN AND DOES NOT CALL ANY SUBROUTINES
C ITSELF.
C INPUTS: EPSLN, ALPHA, A, BETA, INDEX, LINDEX, MNDEX
C OUTPUTS: BB, BO
C
      SUBROUTINE BBEE(BB,EPSLN,ALPHA,A,BETA,BO,INDEX,LINDEX,MNDEX)
      REAL*8 BB(40,20,1),EPSLN,AN,ALPHA(20,1),A(40,20,1)
      REAL*8 BETA(20,1),BO(20,1),DENOM
      DENOM=6.0D0
      DO 1 L=1,(INDEX-1),2
        BB(1,L,1)=1.0D0/BETA(L,1)-1.0D0
        BB(3,L,1)=(-4.0D0*(A(2,L,1)+1.0D0)+BB(1,L,1)*
          *(ALPHA(L,1)-EPSLN*EPSLN-4.0D0))/DENOM
        AN=5.0D0
        DO 2 N=5,(MNDEX-1),2
          BB(N,L,1)=(BB(N-2,L,1)*(ALPHA(L,1)-EPSLN*EPSLN-
            *(AN-2.0D0)*(AN+1.0D0))-2.0D0*(AN-1.0D0)*
              *(A(N-1,L,1)+A(N-3,L,1))-EPSLN*EPSLN*BB(N-4,L,1))
            */(AN*(AN-1.0D0))
          AN=AN+2.0D0
        2 CONTINUE
      1 CONTINUE
      DO 3 L=2,INDEX,2
        BO(L,1)=-1.0D0/BETA(L,1)
        BB(2,L,1)=(-2.0D0*(ALPHA(L,1)-EPSLN*EPSLN)*BO(L,1))/2.0D0
        BB(4,L,1)=(-6.0D0*(A(3,L,1)+1.0D0)-EPSLN*EPSLN*BO(L,1)+
          *BB(2,L,1)*(ALPHA(L,1)-10.0D0-EPSLN*EPSLN))/12.0D0
        AN=6.0D0
        DO 4 N=6,MNDEX,2
          BB(N,L,1)=(BB(N-2,L,1)*(ALPHA(L,1)-EPSLN*EPSLN-
            *(AN-2.0D0)*(AN+1.0D0))-2.0D0*(AN-1.0D0)*
              *(A(N-1,L,1)+A(N-3,L,1))-EPSLN*EPSLN*BB(N-4,L,1))
            */(AN*(AN-1.0D0))
          AN=AN+2.0D0
        4 CONTINUE
      3 CONTINUE
      RETURN
      END

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C
C
C      ** SUBROUTINE GCEE **
C
C THIS SUBROUTINE CALCULATES THE G'S IN EQUATION 48 REFERENCE 1.
C THIS SUBROUTINE IS CALLED BY MAIN AND DOES NOT CALL ANY SUBROUTINES
C ITSELF.
C INPUTS: EPSLN,BB,B0,INDEX,MNDEX
C OUTPUT: G
C
      SUBROUTINE GCEE(EPSLN,BB,G,B0,INDEX,MNDEX)
      REAL*8 EPSLN,BB(40,20,1),G(20,1),AN,TERM,B0(20,1),PSI
      PSI=3.1415926536D0/(2.0D0*EPSLN)
      DO 1 L=2,INDEX,2
      TERM=B0(L,1)
      AN=2.0D0
      DO 2 N=2,MNDEX,2
      TERM=TERM+BB(N,L,1)*(PSI**AN)
      AN=AN+2.0D0
2 CONTINUE
      G(L,1)=TERM/DSQRT(1.0D0+PSI**2.0D0)
1 CONTINUE
      DO 3 L=1,(INDEX-1),2
      TERM=0.0D0
      AN=1.0D0
      DO 4 N=1,(MNDEX-1),2
      TERM=TERM+BB(N,L,1)*(PSI**AN)
      AN=AN+2.0D0
4 CONTINUE
      G(L,1)=TERM/DSQRT(1.0D0+PSI**2.0D0)
3 CONTINUE
      RETURN
      END
C
C
C      ** SUBROUTINE RAD1 **
C
C THIS SUBROUTINE CALCULATES THE RADIAL FUNCTION OF THE FIRST KIND,
C V1, USING EQUATION 34 IN REFERENCE 1.
C THIS SUBROUTINE IS CALLED FROM MAIN BUT DOES NOT CALL ANY SUBROUTINES
C ITSELF.
C INPUTS: EPSLN,A,INDEX,LNDEX
C OUTPUT: V1
C
      SUBROUTINE RAD1(EPSLN,A,V1,INDEX,LNDEX)
      REAL*8 EPSLN,A(40,20,1),V1(20,1),AN,TERM,PSI
      PSI=3.1415926536D0/(2.0D0*EPSLN)
      DO 1 L=2,INDEX,2
      TERM=0.0D0
      AN=1.0D0
      DO 2 N=1,(LNDEX-1),2
      TERM=TERM+A(N,L,1)*(PSI**AN)
      AN=AN+2.0D0
2 CONTINUE
      V1(L,1)=TERM*DSQRT(1.0D0+PSI**2.0D0)
1 CONTINUE
      DO 3 L=1,(INDEX-1),2
      TERM=1.0D0
      AN=2.0D0
      DO 4 N=2,LNDEX,2
      TERM=TERM+A(N,L,1)*(PSI**AN)
      AN=AN+2.0D0
4 CONTINUE
      V1(L,1)=TERM*DSQRT(1.0D0+PSI**2.0D0)
3 CONTINUE
      RETURN
      END

```

```

C
C
C      ** SUBROUTINE RAD2 **
C
C THIS SUBROUTINE CALCULATES THE RADIAL FUNCTION OF THE SECOND KIND,
C V2, USING EQUATION 46, REFERENCE 1.
C THIS SUBROUTINE IS CALLED BY MAIN BUT DOES NOT CALL ANYTHING ITSELF.
C INPUTS: EPSLN,G,V1,Q2,INDEX
C OUTPUT: V2
C
      SUBROUTINE RAD2(V2,EPSLN,G,V1,Q2,INDEX)
      REAL*8 V2(20,1),G(20,1),V1(20,1),Q2(20,1),EPSLN,C,PSI
      PSI=3.1415926536D0/(2.0D0*EPSLN)
      C=-3.1415926536D0/2.0D0
      DO 1 L=1,INDEX
      V2(L,1)=Q2(L,1)*(V1(L,1)*(DATAN(PSI)+C)+G(L,1))
1 CONTINUE
      RETURN
      END
C
C      ** SUBROUTINE RADRES **
C
C THIS SUBROUTINE CALCULATES THE RADIATION RESISTANCE, R, USING
C EQUATION 45, REFERENCE 2.
C THIS SUBROUTINE IS CALLED BY MAIN AND DOES NOT CALL ANY
C SUBROUTINES ITSELF.
C INPUTS: N,EPSLN,B,INDEX
C OUTPUT: R
C
      SUBROUTINE RADRES(B,N,EPSLN,R,INDEX)
      REAL*8 R,N(20,1),EPSLN,TERM
      COMPLEX*8 B(20)
      TERM=0.0D0
      DO 1 L=1,INDEX
      TERM=TERM+N(L,1)*(CABS(B(L))**2.0)
1 CONTINUE
      R=(EPSLN**4.0D0)*TERM*60.0D0
      R=R*0.99930833D0
      RETURN
      END

```



```

C
C          ** SUBROUTINE IMPROV **
C
C THIS SUBROUTINE CALCULATES THE EXACT EIGENVALUES USING THE
C RECURSIVE HALF INTERVAL METHOD. FIRST IT COMPUTES AN ERROR
C BETWEEN A PREVIOUS EIGENVALUE(GAM) AND AN EIGENVALUE RETURNED
C FROM THE CONTINUED FRACTION(ZE OR ZO). ZE OR ZO IS OBTAINED BY
C PLUGGING GAM INTO THE CONTINUED FRACTION. POSITIVE OR NEGATIVE
C ERROR TELLS THE PROGRAM TO SEARCH DOWN OR UP. ONCE A POSITIVE
C ERROR AND NEGATIVE ERROR HAVE BEEN FOUND, CORRESPONDING TO TWO INPUTS
C TO THE CONT. FRAC., THE PROGRAM DECLARES THAT IT HAS FOUND THE
C INTERVAL WHERE THE ROOT(PRESUMABLY THE EIGENVALUE) OF THE CONTINUED
C FRACTION LIES.
C FROM HERE THE HALF INTERVAL METHOD TAKES OVER. THE HALF INTERVAL
C METHOD OPERATES BY CUTTING THE INTERVAL IN HALF, FIGURING OUT IN
C WHICH INTERVAL THE ROOT LIES AND CUTTING IT IN HALF AGAIN. THIS
C REPEATS UNTIL THE ERROR IS LESS THAN SOME TOLERANCE(TOLER).
C THIS SUBROUTINE IS CALLED BY MAIN, AND CALLS SUBROUTINE EVEN AND
C SUBROUTINE ODD.
C INPUTS: EPSLN, INDEX, GAM
C OUTPUT: GAMIMP
C
      SUBROUTINE IMPROV(GAM,GAMIMP,EPSLN,INDEX)
      REAL*8 GAM(20,1),ZO(20,1),ZE(20,1),AL,EPSLN,XL(20,1)
      REAL*8 GAMIMP(20,1),ERROR(20,1),TOLER,XM(20,1),XU(20,1)
      TOLER=0.0000001D0
C
C  L ODD,(L-1) EVEN
C
      AL=1.0D0
      DO 1 L=1,(INDEX-1),2
      I=1
      J=1
      CALL EVEN(ZE(L,1),AL,L,GAM(L,1),EPSLN)
      ERROR(L,1)=GAM(L,1)-ZE(L,1)
      IF(ERROR(L,1).LE.TOLER.AND.ERROR(L,1).GE.-TOLER) GOTO 2
      IF(ERROR(L,1).LT.-TOLER) GOTO 3
C
C  ERROR IS POSITIVE
C
      5 GAM(L,1)=GAM(L,1)-0.5D0
      I=I+1
      IF(I.GT.1000) GOTO 4
      CALL EVEN(ZE(L,1),AL,L,GAM(L,1),EPSLN)
      ERROR(L,1)=GAM(L,1)-ZE(L,1)
      IF(ERROR(L,1).LE.TOLER.AND.ERROR(L,1).GE.-TOLER) GOTO 2
      IF(ERROR(L,1).GT.TOLER) GOTO 5
C
C  FOUND THE INTERVAL
C
C      WRITE(4,7) I,L
      7 FORMAT(1X,'FOUND THE INTERVAL',2X,2I5)
      GOTO 6

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```

C
C ERROR IS NEGATIVE
C
3 GAM(L,1)=GAM(L,1)+0.5D0
  I=I+1
  IF(I.GT.1000) GOTO 4
  CALL EVEN(ZE(L,1),AL,L,GAM(L,1),EPSLN)
  ERROR(L,1)=GAM(L,1)-ZE(L,1)
  IF(ERROR(L,1).LE.TOLER.AND.ERROR(L,1).GE.-TOLER) GOTO 2
  IF(ERROR(L,1).LT.-TOLER) GOTO 3
C
C FOUND THE INTERVAL
C
C WRITE(4,7) I,L
C
C HALF INTERVAL METHOD
C
  XU(L,1)=GAM(L,1)
  XL(L,1)=GAM(L,1)-0.5D0
  GOTO 8
6 XU(L,1)=GAM(L,1)+0.5D0
  XL(L,1)=GAM(L,1)
8 XM(L,1)=(XU(L,1)+XL(L,1))/2.0D0
  J=J+1
  IF(J.GT.100) GOTO 14
  CALL EVEN(ZE(L,1),AL,L,XM(L,1),EPSLN)
  ERROR(L,1)=XM(L,1)-ZE(L,1)
  IF(ERROR(L,1).LE.TOLER.AND.ERROR(L,1).GE.-TOLER) GOTO 2
  IF(ERROR(L,1).LT.-TOLER) GOTO 9
  XU(L,1)=XM(L,1)
  GOTO 8
9 XL(L,1)=XM(L,1)
  GOTO 8
C
C CONVERGENCE
C
2 CONTINUE
11 FORMAT(1X,'CONVERGENCE',2X,E12.5,1X,F20.15,1X,I4)
  GAMIMP(L,1)=XM(L,1)
  AL=AL+2.0D0
  GOTO 1
C
C DID NOT FIND THE INTERVAL
C
4 WRITE(4,12)
12 FORMAT(1X,'DID NOT FIND THE INTERVAL')
  AL=AL+2.0D0
  GOTO 1
C
C NONCONVERGENCE
C
14 WRITE(4,13)
13 FORMAT(1X,'HALF INTERVAL METHOD DID NOT CONVERGE')
  AL=AL+2.0D0
  1 CONTINUE
C
C
C L EVEN,(L-1) ODD
C
  AL=2.0D0
  DO 21 L=2,INDEX,2
  I=1
  J=1
  CALL ODD(ZO(L,1),AL,L,GAM(L,1),EPSLN)
  ERROR(L,1)=GAM(L,1)-ZO(L,1)
  IF(ERROR(L,1).LE.TOLER.AND.ERROR(L,1).GE.-TOLER) GOTO 22
  IF(ERROR(L,1).LT.-TOLER) GOTO 23

```

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```

C
C ERROR IS POSITIVE
C
25 GAM(L,1)=GAM(L,1)-0.5D0
   I=I+1
   IF(I.GT.1000) GOTO 24
   CALL ODD(ZO(L,1),AL,L,GAM(L,1),EPSLN)
   ERROR(L,1)=GAM(L,1)-ZO(L,1)
   IF(ERROR(L,1).LE.TOLER.AND.ERROR(L,1).GE.-TOLER) GOTO 22
   IF(ERROR(L,1).GT.TOLER) GOTO 25
C
C FOUND THE INTERVAL
C
C WRITE(4,27) I,L
27 FORMAT(1X,'FOUND THE INTERVAL',2X,2I5)
   GOTO 26
C
C ERROR IS NEGATIVE
C
23 GAM(L,1)=GAM(L,1)+0.5D0
   I=I+1
   IF(I.GT.1000) GOTO 24
   CALL ODD(ZO(L,1),AL,L,GAM(L,1),EPSLN)
   ERROR(L,1)=GAM(L,1)-ZO(L,1)
   IF(ERROR(L,1).LE.TOLER.AND.ERROR(L,1).GE.-TOLER) GOTO 22
   IF(ERROR(L,1).LT.-TOLER) GOTO 23
C
C FOUND THE INTERVAL
C
C WRITE(4,27) I,L
C
C HALF INTERVAL METHOD
C
   XU(L,1)=GAM(L,1)
   XL(L,1)=GAM(L,1)-0.5D0
   GOTO 28
26 XU(L,1)=GAM(L,1)+0.5D0
   XL(L,1)=GAM(L,1)
28 XM(L,1)=(XU(L,1)+XL(L,1))/2.0D0
   J=J+1
   IF(J.GT.100) GOTO 214
   CALL ODD(ZO(L,1),AL,L,XM(L,1),EPSLN)
   ERROR(L,1)=XM(L,1)-ZO(L,1)
   IF(ERROR(L,1).LE.TOLER.AND.ERROR(L,1).GE.-TOLER) GOTO 22
   IF(ERROR(L,1).LT.-TOLER) GOTO 29
   XU(L,1)=XM(L,1)
   GOTO 28
29 XL(L,1)=XM(L,1)
   GOTO 28
C
C CONVERGENCE
C
22 CONTINUE
211 FORMAT(1X,'CONVERGENCE',2X,E12.5,1X,F20.15,1X,I4)
   GAMIMP(L,1)=XM(L,1)
   AL=AL+2.0D0
   GOTO 21
C
C DID NOT FIND THE INTERVAL
C
24 WRITE(4,212)
212 FORMAT(1X,'DID NOT FIND THE INTERVAL')
   AL=AL+2.0D0
   GOTO 21
C
C NONCONVERGENCE
C
214 WRITE(4,213)
213 FORMAT(1X,'HALF INTERVAL METHOD DID NOT CONVERGE')
   AL=AL+2.0D0
21 CONTINUE
   RETURN
   END

```

```

C
C      ** SUBROUTINE ODD **
C
C THIS SUBROUTINE CALCULATES THE CONTINUED FRACTION AS PER
C EQUATION 20, REFERENCE 1. TERM1 AND TERM2 ARE THE FRACTION TERMS
C IN THE CONTINUED FRACTION. EVALUATION IS STARTED WITH THE
C LAST FRACTION TERM AND IS RECURSIVELY WORKED FORWARD UNTIL
C THE ENTIRE CONT. FRAC. IS EVALUATED. THE TWO CONTINUED FRACTIONS
C ARE THEN ADDED TOGETHER TO GIVE THE FINAL RESULT.
C THIS SUBROUTINE IS CALLED BY IMPROV AND DOES NOT CALL ANY
C SUBROUTINES.
C INPUTS: AL,L,GAM,EPSLN
C OUTPUT: ZO
C
      SUBROUTINE ODD(ZO,AL,L,GAM,EPSLN)
      REAL*8 A1,A2,A3,A4,ZO,TERM1,TERM2,AL,GAM,EP,EPSLN,ALM
      REAL*8 M
      M=1.0D0
      ALM=AL*2.0D0
      A1=201.0D0
      A2=200.0D0
      A3=199.0D0
      A4=198.0D0
      EP=EPSLN*EPSLN
      TERM1=0.0D0
      TERM2=0.0D0
      DO 1 I=1,100
      TERM1=(AL+A3+M)*(AL+A4)*EP/(A2*(ALM+A1)-GAM+TERM1)
      TERM2=(AL-A3+M)*(AL-A2)*EP/(A2*(ALM-A3)+GAM+TERM2)
      A1=A1-2.0D0
      A2=A2-2.0D0
      A3=A3-2.0D0
      A4=A4-2.0D0
1  CONTINUE
      ZO=TERM1-TERM2
      RETURN
      END

```


MONOPL (18 of 18 pages)

```
C
C
C          ** SUBROUTINE EVEN **
C
C THIS SUBROUTINE CALCULATES THE CONTINUED FRACTION AS PER
C EQUATION 19, REFERENCE 1. TERM1 AND TERM2 ARE THE FRACTION TERMS
C IN THE CONTINUED FRACTION. EVALUATION IS STARTED WITH THE LAST
C FRACTION TERM AND IS RECURSIVELY WORKED FORWARD UNTIL THE ENTIRE
C CONTINUED FRACTION IS EVALUATED. THE TWO CONTINUED FRACTIONS
C ARE THEN ADDED TOGETHER TO GIVE THE FINAL RESULT.
C THIS SUBROUTINE IS CALLED BY IMPROV AND DOES NOT CALL ANY
C OTHER SUBROUTINES.
C INPUTS: AL,L,GAM,EPSLN
C OUTPUT: ZE
C
      SUBROUTINE EVEN(ZE,AL,L,GAM,EPSLN)
      REAL*8 A1,A2,A3,A4,ZE,TERM3,TERM4,AL,GAM,EP,EPSLN,ALM
      REAL*8 M
      M=1.0D0
      ALM=AL*2.0D0
      EP=EPSLN*EPSLN
      A1=201.0D0
      A2=200.0D0
      A3=199.0D0
      A4=198.0D0
      TERM3=0.0D0
      TERM4=0.0D0
      DO 1 I=1,100
      TERM3=(AL+A2+M)*(AL+A3)*EP/(A2*(ALM+A1)-GAM+TERM3)
      TERM4=(AL-A4+M)*(AL-A3)*EP/(A2*(ALM-A3)+GAM+TERM4)
      A1=A1-2.0D0
      A2=A2-2.0D0
      A3=A3-2.0D0
      A4=A4-2.0D0
1  CONTINUE
      ZE=TERM3-TERM4
      RETURN
      END
>
```

APPENDIX B4. LISTING OF PROGRAM "MONOSTOR"
(Variational Method)

APPENDIX B4. PROGRAM MONOSTOR

```

C      THIS PROGRAM, IN FORTRAN LANGUAGE, CALCULATES THE INPUT
C      IMPEDANCE Z OF A 1/4 WAVELENGTH MONOPOLE ANTENNA MOUNTED
C      ON A CIRCULAR GROUNDPLANE OF RADIUS A FOR  $E=2\pi A/\lambda$ 
C      GREATER THAN APPROXIMATELY 30. WHERE  $\lambda$  IS THE FREE
C      SPACE WAVELENGTH.
C
C      REFERENCE: J.A. STORER, "THE IMPEDANCE OF AN ANTENNA OVER A
C      LARGE CIRCULAR SCREEN", J. APPL. PHYS., VOL 22, NO. 8, PP. 1058-1066,
C      AUGUST 1951, EQUATION PRECEDING EQUATION 20.
C
C      LET      FS=FREE SPACE WAVE IMPEDANCE
C               R=RE(Z)=RADIATION RESISTANCE
C               X=IM(Z)=REACTANCE
C               ZINF=IMPEDANCE FOR E=INFINITY
C               RINF=RADIATION RESISTANCE FOR E=INFINITY
C               XINF=REACTANCE FOR E=INFINITY
C               K=D(PI/2)NUMERIC=DIRECTIVE GAIN (NUMERIC) FOR
C                 ELEVATION ANGLE OF PI/2 RADIAN
C               K1=D(PI/2)DBI=DIRECTIVE GAIN (DBI) FOR
C                 ELEVATION ANGLE OF PI/2 RADIAN
C               RO=RADIATION RESISTANCE OF MONOPOLE FOR E=0
C               DO=DIRECTIVE GAIN AT AN ELEVATION ANGLE PI/2
C                 RADIAN OF MONOPOLE FOR E=0
C*****
C      REAL F(200)
C      REAL K(200),K1(200),G(200)
C      COMPLEX C1,C2,C3,C4,C5,ZINF,ZF(200),Z(200),C6
C      FS=376.73037
C      PI=3.141592654
C      DO=1.54259
C      RO=19.43387
C      WRITE (6,15)
15  FORMAT ('1',////////)
C      DO 10 M=1,150
C      READ (5,20)E(M)
20  FORMAT(F15.7)
10  CONTINUE
C      M=1
40  C1=CMPLX (0.,-FS/(4.*PI+E(M)))
C      C3=CMPLX (COS(2.*E(M)+3.*PI/4.),SIN(2.*E(M)+3.*PI/4.))
C      C2=CMPLX (COS(2.*E(M)),SIN(2.*E(M)))
C      C4=C3/SQRT(4*PI+E(M))
C      C5=1+C4
C      C6=1/C5
C      ZF(M)=C1+C2+C6
C      ZINF=CMPLX (36.539509,0.)
C      Z(M)=ZF(M)+ZINF
C      G(M)=REAL(ZD(M))
C      K(M)=DO*RO/G(M)
C      K1(M)=10.*ALOG10(K(M))
C      WRITE (6,25)E(M),ZF(M),Z(M),K(M),K1(M)
25  FORMAT (1X,7F15.7)
C      IF (M.GT.149) GO TO 50
C      M=M+1
C      GO TO 40
50  STOP
C      END

```

APPENDIX B5. LISTING OF PROGRAM "AWADALLA"
(Method of Moments Combined with Geometric
Theory of Diffraction)

```

C      PROGRAM AWADALLA
C*****
C      THIS COMPUTER PROGRAM, IN FORTRAN LANGUAGE,
C      WAS WRITTEN BY PROF. AWADALLA OF MANOUFIA UNIVERSITY, EGYPT.
C      IT USES THE METHOD OF MOMENTS AND THE GEOMETRIC THEORY OF
C      DIFFRACTION TO COMPUTE THE INPUT IMPEDANCE AND THE DIRECTIVITY
C      PATTERN OF A MONOPOLE ELEMENT OF LENGTH h AND RADIUS b AT THE
C      CENTER OF A CIRCULAR GROUNDPLANE OF RADIUS a. DETAILED
C      DERIVATIONS ARE PUBLISHED BY IN REFERENCES 1 AND 2.
C
C      THIS PROGRAM REQUIRES THREE INPUTS WHICH ARE ENTERED FROM
C      AN INPUT FILE NAMED "AIN.DAT" WITH FORMAT 172.
C
C      b = AL - MONOPOLE RADIUS IN WAVELENGTHS
C      h = AH - MONOPOLE LENGTH IN WAVELENGTHS
C       $2\pi a / \lambda = \epsilon = \text{EPSLN}$  - NORMALIZED GROUNDPLANE RADIUS IN WAVENUMBERS
C
C      THIS PROGRAM ALSO REQUIRES THE USE OF THE MMBSJ1 SUBROUTINE
C      FUNCTION OF THE IMSL SOFTWARE LIBRARY. MMBSJ1 IS THE MODIFIED
C      BESSEL FUNCTION OF THE FIRST KIND AND ORDER ONE.
C
C      REFERENCE:
C
C      1. K.H. AWADALLA AND T.S.M. MACLEAN, "INPUT IMPEDANCE OF
C      A MONOPOLE ANTENNA AT THE CENTER OF A FINITE GROUNDPLANE",
C      IEEE TRANS. ON ANTENNAS AND PROPAGATION, VOL. AP-26, NO. 2,
C      MARCH 1978, PP. 244-248
C
C      2. K.H. AWADALLA AND T.S.M. MACLEAN, "MONOPOLE ANTENNA
C      AT THE CENTER OF CIRCULAR GROUNDPLANE: INPUT IMPEDANCE
C      AND RADIATION PATTERN", IEEE TRANS. ON ANTENNAS AND
C      PROPAGATION, VOL. AP-27, NO. 2, MARCH 1979, PP. 151-153
C
C      NOTE: THE NUMBER OF MONOPOLE SEGMENTS USED IN THE PROGRAM
C      IS 30. IF THE NUMBER OF MONOPOLE SEGMENTS IS CHANGED
C      TO N, THEN THE DIMENSION OF ALL THE ARRAYS OF 30, AND
C      30x30 SHOULD BE CHANGED INTO N, AND NxN.
C*****
C
C      INTEGER IER
C      REAL MMBSJ1
C      COMPLEX Z(30,30), ZAZ(30,30), B(30), ZC(30), FF, JHF(100)
C      1 , EP, C1, C2, EPPM, EPMP, ZT, PSI, ZMG, YIN, ZIN, CDH, DH, EDP, SMP, ZT2
C      2 , SM2, CMEV, ZT1, JLD(100), YAY
C      DIMENSION IH(30), AUTDB(182), Y2(182), AUT(182), Y1(182)
C      DIMENSION AUT2(182), DIRECT(182), DIRDB(182), Y(182)
C      COMMON DL, RH01, PI, AK
C      OPEN(UNIT=6, FILE='ADUT', STATUS='NEW')
C      OPEN(UNIT=5, FILE='AIN.DAT', STATUS='OLD', READONLY)
C      DO 555 LI=1,35
C      N=30
C      FMHZ=1000.0
C      FREQ=FMHZ*1.0E6
C      ALAMDA=3.0E8/FREQ
C*****
C      INPUT READ STATEMENT
C*****
C      READ(5,172)AL, AH, EPSLN
C      172  FORMAT(3F12.8)
C      WRITE(6,990)
C      990  FORMAT(1H1, 'AWADALLA RESULT')

```


AWADALLA (2 of 8 pages)

```

WRITE(6, 171)EPSLN, AH, AL
171  FORMAT(1X, 'EPSLN= ', 1F12.8, ' (NORMALIZED GROUNDPLANE RADIUS)',
1    /1X, 'MONOPILE LENGTH= ', 1F12.8, ' (WAVELENGTH)'
2    /1X, 'MONOPILE RADIUS= ', 1F12.8, ' (WAVELENGTH)')
R=AL*ALAMDA
PI=4.0*ATAN(1.0)
OM=2.0*PI*FREQ
AK=2.0*PI/ALAMDA
AMU=4.0*PI*1.0E-7
EPSI=1.0/(36.0*PI*1.0E9)
DL=AH*ALAMDA/(FLOAT(N)+0.5)
A=DL/2.0
C1=CMPLX(0.0, OM*AMU*DL*DL)
C2=CMPLX(0.0, -1.0/(OM*EPSI))
RHO1=EPSLN*ALAMDA/(2.*PI)
DO 333 I=1, N
B(I)=CMPLX(0., 0.)
333  IH(I)=0
      EP=PSI(0.0, R, A, AK, PI)
      EPPM=PSI(DL, R, A, AK, PI)
      ZT=C1*EP+2.0*C2*(EP-EPPM)
      Z(1, 1)=ZT
      RMNPM=DL
      NN=N+N
      DO 12 IN=2, NN
      EPMP=EP
      EP=EPPM
      RMNPM=RMNPM+DL
      EPPM=PSI(RMNPM, R, A, AK, PI)
      ZT=C2*(EP+EP-EPMP-EPPM)
      IF(IN.GT.N)GO TO 13
      Z(1, IN)=C1*EP+ZT
      GO TO 12
13    IC=IN-N
      ZC(IC)=C1*EP+ZT
12    CONTINUE
      DO 16 J=1, N
      DO 11 I=J, N
      IA=I-J+1
      Z(J, I)=Z(1, IA)
11    Z(I, J)=Z(J, I)
16    CONTINUE
      DO 22 K=2, N
      DO 20 I=1, N
      IB=I+K
      IF(IB.GT.N)GO TO 21
      Z(K, I)=Z(K, I)+Z(1, IB)
      GO TO 20
21    IC=IB-N
      Z(K, I)=Z(K, I)+ZC(IC)
20    CONTINUE
22    CONTINUE
      NF=N-1
      DO 200 I=1, NF
      IZ=I+1
200    Z(1, I)=Z(1, I)+Z(1, IZ)
      Z(1, N)=Z(1, N)+ZC(1)
      DO 121 I=1, N
      DO 122 J=1, N
      ZAZ(I, J)=Z(I, J)
122    CONTINUE

```

```

121      CONTINUE
C*****
C      DIFFRACTION EFFECT OF THE EDGE OF GROUNDPLANE      *
C*****
      DO 30 I=1,N
      ZS=DL*(FLOAT(I)-0.5)
      DO 32 J=I,N
      ZO=DL*(FLOAT(J)-0.5)
      Z(I,J)=Z(I,J)+ZMG(ZS,ZO)
32      Z(J,I)=Z(I,J)
30      CONTINUE
C*****
C      CALCULATION OF THE ADMITTANCE      *
C*****
150      CALL MTXINV(Z,N,B,IH)
151      ZIN=1.0/Z(1,1)
      WRITE(6,23)ZIN
23      FORMAT(1X,'INPUT IMPEDANCE=','E15.9,'+J',E15.9,2X,'(OHMS)')
      WRITE(6,999)
999      FORMAT(1X,'ELEVATION',53X,'ELEVATION',/1X,2(
1      'ANGLE',6X,'DIRECTIVITY',5X,'DIRECTIVITY',5X,
2      'RELATIVE POWER',5X),/1X,2(' (DEG)',6X,' (NUMERIC)',
3      7X,' (dB)',11X,' (dB)',15X))
C*****
C      COMPUTING THE E FIELD RADIATION PATTERN      *
C*****
      CDH=-CMPLX(1.,1.)/SQRT(2.*PI)
      AKA=AK*RHO1
      PID2=PI/2.
      PI4=4.*PI
      PID4=PI/4.
      SAKP=SQRT(AK/(PI*B.))
      DTH=PI/180.
      TH=0.
      RHO2=RHO1*RHO1
      ZT=CMPLX(0.,0.)
      NG=RHO1/(0.05*ALAMDA)
      DR=RHO1/NG
      RG=DR/2.0
      CJHF=-2.*DL/PI4
      DO 40 IK=1,NG
      ZT1=CMPLX(0.,0.)
      ZT=CMPLX(0.,0.)
      H=A
      DO 41 J=1,N
      RG2=RG*RG
      H2=H*H
      RA2=RG2+H2
      RA=SQRT(RA2)
      SNA=RG/RA
      AKRA=-AK*RA
      CSAKRA=COS(AKRA)
      SNAKRA=SIN(AKRA)
      ZT=ZT+Z(1,J)*(SNA/RA)*CMPLX(CSAKRA,SNAKRA)*CMPLX(1.0/RA,AK)
      RI2=RHO2+H2
      RI=SQRT(RI2)
      AKRI=-AK*RI
      AK1=-AK*(RHO1-RG)
      ZT1=ZT1+Z(1,J)*RHO1*DL*CMPLX(COS(AKRI),SIN(AKRI))*CMPLX(1./RI,AK)
1      *CMPLX(COS(AK1),SIN(AK1))/(PI4*RI)
      H=H+DL

```

```

41  CONTINUE
    JHF(IK)=ZT*CJHF+ZT1*2.0
    JLD(IK)=ZT1*2.0
    RG=RG+DR
40  CONTINUE
    FCR=RHO1*SQRT(2.*AK)/PI*DL
    DO 33 I=1,181
        SNTH=SIN(TH)
        CSTH=COS(TH)
        H=A
        EDP=CMPLX(0.,0.)
    DO 34 J=1,N
        S=SQRT(H*H+RHO2)
        PHI=ATAN(RHO1/H)
        SB=PI-PHI
        RB=PID2-PHI
        AI=1.0
100  ZKC=AK*H*CSTH
        EDP=EDP+Z(1,J)*SNTH*DL*AI*CMPLX(COS(ZKC),SIN(ZKC))
34   H=H+DL
        THA=TH*180.0/PI
        ZT=CMPLX(0.,0.)
        RG=DR/2.
        CONST=-2.*PI*DR*CSTH
        AKSN=AK*SNTH
    DO 42 K=1,NG
        X=AKSN*RG
        IF(X.LT.0.1E-6)GO TO 44
        SABF=MMBSJ1(X,IER)
        GO TO 45
44   SABF=0.0
45   ZT=ZT+JHF(K)*SABF*CMPLX(0.,CONST)*RG
47   RG=RG+DR
42  CONTINUE
43  EDP=EDP+ZT
    AEDP=CABS(EDP)
    AUT(I)=AEDP
    AUT2(I)=AEDP*AEDP
    IF(AEDP.EQ.0.0) GO TO 33
    PHASE=180.0*ATAN2(AIMAG(EDP),REAL(EDP))/PI
33  TH=TH+DTH
    X=0.0
    DO 70 K=1,181
        CHO=AUT(K)
70  IF (CHO.GT.X) X=CHO
    DO 71 I=1,181
        Y(I)=AUT(I)/X
        Y1(I)=Y(I)*Y(I)
        IF(Y1(I).EQ.0.)THEN
            Y2(I)=999
            AUTDB(I)=999
        ELSE
            AUTDB(I)=10*ALOG10(AUT(I))
            Y2(I)=10*ALOG10(Y1(I))
        END IF
71  CONTINUE
C*****
C    COMPUTE THE DIRECTIVITY PATTERN      *
C*****
    PR=0.0
    DO 995 I=2,181

```

```

      DEL=(I-1)*DTH
      PR=PR+AUT2(I)*SIN(DEL)*DTH
995  CONTINUE
      DO 994 I=1,181
      DIRECT(I)=2*AUT2(I)/PR
      IF(DIRECT(I).EQ.0.)THEN
      DIRDB(I)=999
      ELSE
      DIRDB(I)=10*ALOG10(DIRECT(I))
      END IF
994  CONTINUE
      DO 998 I=1,45
      II=I-1
      II2=I+43
      II3=II2+1
      IF(I.EQ.1)THEN
      WRITE(6,997)II,AUT(I)
997  FORMAT(2X,I3,8X,F9.5,5X,'-INFINITE',6X,'-INFINITE')
      ELSE
      WRITE(6,996)II,DIRECT(I),DIRDB(I),Y2(I),II2,DIRECT(II3)
1      ,DIRDB(II3),Y2(II3)
996  FORMAT(1X,2(1X,I3,8X,F9.5,5X,F9.5,6X,F9.5,11X))
      END IF
998  CONTINUE
      WRITE(6,990)
      WRITE(6,171)EPSLN,AH,AL
      WRITE(6,23)ZIN
      WRITE(6,999)
      DO 992 I=90,136
      II=I-1
      II2=I+44
      II3=II2+1
      WRITE(6,996)II,DIRECT(I),DIRDB(I),Y2(I),II2,DIRECT(II3)
1      ,DIRDB(II3),Y2(II3)
992  CONTINUE
555  CONTINUE
      CLOSE(UNIT=6,STATUS='KEEP')
      CLOSE(UNIT=5,STATUS='KEEP')
      STOP
      END

```

```

C*****
C      SUBROUTINE ZMG                                     *
C*****
      COMPLEX FUNCTION ZMG(ZS, ZO)
      COMMON DL, RHO1, PI, AK
      ZO2=ZO*ZO
      ZS2=ZS*ZS
      RH2=RHO1*RHO1
      RS2=RH2+ZS2
      RO2=RH2+ZO2
      RS=SQRT(RS2)
      RO=SQRT(RO2)
      AKA=AK*(RS+RO)
      PS=ATAN(ZS/RHO1)
      PO=ATAN(ZO/RHO1)
      ZMG=15.*DL*DL*RHO1*RH2/(AK*RS2*RO2)*CMPLX(0., -1.)*
1    CEXP(CMPLX(0., -AKA))*(1./COS((PO-PS)/2.)+1./COS((PO+PS)/2.))
2    *CMPLX(1./RS, AK)*CMPLX(1./RO, AK)
35   RETURN
      END

```

```

C*****
C      SUBROUTINE PSI                                     *
C      *                                                 *
C      THIS FUNCTION IS TO CALCULATE THE SELF AND MUTUAL *
C      IMPEDANCES FOR A STRAIGHT WIRE ANTENNA           *
C*****
      COMPLEX FUNCTION PSI(H, R, A, AK, PI)
      IMPLICIT REAL*8 (A-H), (P-Z)
      COMPLEX*16 P1, P2, P3, P4, PII
      R2=R*R
      D=DSQRT(H*H+R2)
      S1=DSQRT(R2+(H+A)**2)
      S2=DSQRT(R2+(H-A)**2)
      AI1=DLOG((H+A+S1)/(H-A+S2))
      AI2=2.*A
      AI3=(A+H)/2.*S1+(A-H)/2.*S2+R2/2.*AI1
      AI4=2.*A*R2+(2.*A*A*A+6.*A*H*H)/3.
      AKA=-AK*D
      PIA=8.*PI*A
      P4=DCMPLX(0.0D0, AKA)
      P1=CDEXP(P4)/PIA
      P2=AI1-(AI2-D*AI1)*DCMPLX(0.0D0, AK)
      P=(AK*AK/2.)*(AI3-2.*D*AI2+AI1*D*D)
      P3=DCMPLX(0.0D0, AK*AK*AK/6.)
      PP=AI4-3.*D*AI3+3.*D*D*AI2
      PP1=D*D*D*AI1
      P5=PP-PP1
      PII=P1*(P2-P+P3*P5)
      PSI=CMPLX(PII)
      RETURN
      END

```



```

C*****
C      SUBROUTINE MTXINV                                     *
C      *                                                     *
C      THIS SUBROUTINE IS FOR THE INVERSION OF A MATRIX A(N,N) *
C      THE MATRIX SHOULD BE A SQUARE ONE OF ORDER "N"      *
C*****
      SUBROUTINE MTXINV(A,N,B,IH)
      COMPLEX A(N,N),B(N),Q
      DIMENSION IH(N)
      DO 24 I=1,N
      B(I)=CMPLX(0.0,0.0)
24      IH(I)=0
      DO 1 K=1,N
      IK=0
12      Z=CABS(A(K,K))
      IF(Z.EQ.0.0) GO TO 6
      Q=1.0/A(K,K)
      GO TO 7
6      IF(K.EQ.N)GO TO 13
      IH(K)=K
      DO 8 I=1,N
      B(I)=A(K,I)
      NA=N-1
      DO 9 I=K,NA
      II=I+1
10      A(I,J)=A(II,J)
9      CONTINUE
      DO 11 J=1,N
11      A(N,J)=B(J)
      IK=IK+1
      IF(IK.EQ.1) GO TO 12
      WRITE (6,22)K,K
22      FORMAT(1X,'MTXINV FAIL BECAUSE ELEMENT Z(',I2,',',I2,
1      ') AND THE NEXT IN THE SAME COLUMN ARE ZEROS'/)
      GO TO 23
7      DO 2 I=1,N
      IF(I.EQ.K) GO TO 2
      DO 3 J=1,N
      IF(J.EQ.K)GO TO 3
      A(I,J)=A(I,J)-A(I,K)*A(K,J)*Q
3      CONTINUE
2      CONTINUE
      DO 4 I=1,N
      IF(I.EQ.K) GO TO 4
      A(I,K)=A(I,K)*Q
4      CONTINUE
      DO 5 I=1,N
      IF(I.EQ.K) GO TO 5
      A(K,I)=-A(K,I)*Q
5      CONTINUE
      A(K,K)=Q
1      CONTINUE
      N1=N+1
      DO 15 I=1,N
      NN=N1-I
      IF(IH(NN).EQ.0) GO TO 15
      DO 16 J=1,N
16      B(J)=A(N,J)
      K=IH(NN)
      KK=N-K

```

AWADALLA (8 of 8 pages)

```
DO 17 J=1, KK
N2=N1-J
N3=N2-1
DO 18 L=1, N
18 A(N2, L)=A(N3, L)
17 CONTINUE
DO 19 L=1, N
19 A(K, L)=B(L)
15 CONTINUE
GO TO 20
13 WRITE (6, 14)
14 FORMAT(1X, 'A(N, N)=0: PROGRAM FAILIOUR. ')
20 RETURN
23 STOP
END
```